Agilent E4991A RF Impedance/Material Analyzer

Programming Manual

Sixth Edition

Agilent Technologies

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Manual Printing History

The manual's printing date and part number indicate its current edition. The printing date changes when a new edition is printed (minor corrections and updates that are incorporated at reprint do not cause the date to change). The manual part number changes when extensive technical changes are incorporated.

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Typeface Conventions

sample (bold)	Boldface type is used for emphasis.
sample (Italic)	Italic type is used for emphasized phrases and titles of manuals in English.
[sample]	Indicates the key on the front panel labeled "**sample**". It also may refer to the label on the

	button.
sample	Indicates the menu, button, or box labeled "**sample**", which can be clicked to carry out the settings and choice. Menu indicates menu bar, pull-down menu, and short-cut menu. Button refers to the buttons in dialog box and setup toolbar. Box indicates the spin box, drop-down list box, text box, and list box.
SAMPLE	Indicates the block or toolbar labeled "**SAMPLE**". Block indicates the key group on the front panel. Tool bar indicates the setup toolbar (the group of buttons and boxes on the setup screen displayed in the right row).
s1 - **s2** - s3 - s4	Indicates a series of operations using the menu or key labeled "**s1**","**s2**" and the button or box in the setup toolbar labeled "**s3**"," **s4**".

Sample Program Disk

Sample program disks (Agilent Part Number E4991-180x0) are furnished with this manual. The disk contains the sample programs used in this manual.

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E4991A Documentation Map

The following manuals are available for the Agilent E4991A.

- ***Operational Manual*** **(Part Number: E4991-900x0, attached to optional ABA)**

  This manual describes most of the basic information necessary to use the E4991A. It provides a function overview, detailed operation procedure for each function (from preparation for measurement to analysis of measurement results), measurement examples, specifications, and supplemental information. For programming guidance on performing automatic measurement with the E4991A, please see the *Programming Manual*.

- ***Installation and Quick Start Guide*** **(Part Number: E4991-902x1, attached to optional ABA)**

  This manual describes installation after it is delivered and the basic operation procedures for applications and analysis. Refer to this manual when you use the E4991A for the first time.

- ***Programming Manual*** **(Part Number: E4991-900x2, attached to optional ABA)**

  This manual provides programming information for performing automatic measurement with the E4991A. It includes an outline of remote control, procedures for detecting measurement start (trigger) and end (sweep end), application programming examples, command reference, and related information.

NOTE The number position shown by “x” in the part numbers above indicates the edition number. This convention is applied to each manual, CD-ROM (for manuals), and sample programs disk issued. Here, “0” indicates the initial edition, and each time a revision is made this number is incremented by 1. The latest edition allows the customer to specify Option ABA (English version).

To Make Effective Use of This Manual 19
Contents of this manual 20
How to use this manual 23
Selecting the structure of remote control system 23
Sample programs 24
Outline of Remote Control 25
Outline of GPIB remote control system 26
System structure 26
Sending GPIB command messages 29
Remote control using E4991A macros 32
System structure 32
How to operate macros 33
Sending command messages 34
Remote mode 34
Remote control using remote user interface function and application software 35
System structure 35
How to use the application software 36
Sending command messages 37
Remote mode 37
Setting Measurement Conditions 39
Set Measurement Parameter 40
Measurement Mode 40
Display Trace 40
Parameters for Scalar Trace 41
Phase Display for Scalar Trace 42
Parameters for Complex Trace 43
Set Sweep Conditions 44
Select Sweep Parameter 44
Set Number of Measurement Points 44
Set Sweep Direction 44
Set Sweep Range 45
Set Sweep Time 47
Set Delay Time 47
Set Frequency Span (only segment sweep) 47
Set Measurement Source 48
Set Source 48
Set DC Bias (DC Bias Function) 49
Set Averaging 50
Sweep Averaging 50
Point Averaging 50
Set Display Scale 51
Select Trace for Which Scale Is Set 51
Automatic Scale Adjustment 51
Manual Setting of Scale 51
Example program for setting the measuring conditions 54

Example program using HTBasic 55
Example program using macro (E4991A VBA) 59
Combination of Several Sweep Conditions (Segment Sweep) 64
Create/Edit Segment Sweep Table 64
Example program for setting the segment sweep conditions 66
Example program using HTBasic 66
Example program using macro (E4991A VBA) 70
Preparation for Accurate Measurement 73
Calibration 74
Define Calibration Kit 74
Define Load Standard Value Used for Measurement of Dielectric Material 75
Select Calibration Data Measurement Points 75
Measure Calibration Data 76
Calibration Data Array/Calibration Coefficient Array 77
Example program for execution of calibration 78
Example program for calibration coefficient transfer 87
Electrical Length Compensation 91
Test Fixture 91
Add Offset Delay Time (Port Extension Compensation) 92
Fixture Compensation 93
Define Fixture Compensation Kit 93
Select Fixture Compensation Data Measurement Points 94
Measure Fixture Compensation Data 95
Fixture Compensation Data Array/Fixture Compensation Coefficient Array 96
Example program for execution of fixture compensation 97
Measurement Start and Detection of Measurement End 107
Measurement Trigger (Measurement Start) 108
Trigger System 108
Trigger Measurement 111
Waiting for Measurement End (Detection of Sweep End) 112
Using the Status Register 112
Adding Wait Time 113
Example Programs for Detecting Measurement End 114
Example program using HTBasic (SRQ) 114
Example program using macro (E4991A VBA) 116
Read and Write Measurement Data 119
Data Transfer Format 120
ASCII Format 120
IEEE 32-Bit Floating Point Format 121
IEEE 64-Bit Floating Point Format 122
Specify Byte Order (Binary Transfer) 122
Internal Data Flow 123
Data Processing Flow 123
Internal Data Arrays 123
Timing for read/write 128

Example Programs for Reading Internal Data Arrays 129
Reading the data trace array (ASCII format) 129
Reading the dc bias level monitor array 133
Measurement Result Processing 139
Using Marker Function 140
Markers 140
Moving Markers and Reading at Marker Positions 141
Setting Δ Mode 142
Entering Marker Values as E4991A Setting 143
Marker Search Function 144
Limit Test Function 147
Statistical Analysis Function 149
Example Programs for Marker Search Function 150
Example Programs for Marker Limit Test Function 159
Equivalent Circuit Analysis 167
Selecting an Equivalent Circuit Model 167
Performing Equivalent Circuit Analysis 168
Simulating Frequency Characteristics 168
Example Programs for Equivalent Circuit Analysis 169
Save and Recall Files 175
Saving and Recalling Files 176
Current Folder 176
Saving Files 177
Recalling Files 178
Automatic Recall of State File 178
Folder and File Manipulation 179
Folders 179
Files 179
Example Programs for Saving/Recalling a File 180
Example program using HTBasic 180
Example program using macro (E4991A VBA) 187
Using Printer 195
Printing out to a Printer Connected to E4991A 196
Selecting Print Contents 196
Selecting Color 196
Performing Printout 196
Cancelling Printing 196
Setting the Display 197
Setting the Display 198
GPIB Commands for Entire Screen (windows) 198
GPIB Commands for Traces 198
When Data Trace Is Refreshed 200
Refresh for Each Sweep 200
Refresh for Each Measurement Point 200
Refresh Periodically 200

Error Handling 201
Using the Error Queue 202
Using Status Report Mechanism 203
Example Program for Error Handling 204
Using HTBasic 204
Using the macro (E4991A VBA) 206
Shutting Down the Instrument 209
Shutdown Procedure 210
Use of Macros 211
Overview of Macros 212
Macro Function Overview 213
Starting Up and Closing Visual Basic Editor 214
Starting up Visual Basic Editor 214
Quitting Visual Basic Editor 214
Displaying the E4991A measurement screen 214
Making/Editing Macros 215
Elements of Visual Basic Editor 215
Describing macros 226
E4991A Library 228
Macro recording 228
Debugging macros 229
Executing and Terminating Macros 230
Executing macros 230
Executing macros by GPIB commands 231
Terminating macros 231
Saving/Loading Macros 232
Saving macros 232
Loading macros 233
Using E4991A VBA Help 234
Displaying the E4991A VBA help screen 234
Displaying topics of E4991A VBA 235
Referring to contents of keywords 235
Outline of Programming Using COM 237
Outline of E4991A COM 238
E4991A COM Object 238
Limitations on using the E4991A COM object 239
Comparison of COM objects and GPIB commands 239
E4991A COM Object Model 242
Application Object 242
SCPI Object 243
E4991A Library 244
Where to install the E4991A library 244
Controlling Peripherals 245
Overview 246
Preparation 246

Programming with VISA 247
STEP 1. Starting up VISA system 248
STEP 2. Connection 248
STEP 3. Communication 249
STEP 4. Disconnection 250
Application program using DC power supply (Agilent E3631A) 251
Application Programs 253
Basic Measurement 254
HTBasic example program 254
Macro (E4991A VBA) Example Program 264
GPIB Command Reference 275
Conventions 276
Format 276
Description 276
Parameters 277
Query response 278
Related command(s) 278
Front Panel Equivalents 278
IEEE subsystem 279
*CLS 279
*ESE 280
*ESR? 280
*IDN? 281
*OPC 281
*OPC? 281
*OPT? 282
*RST 282
*SRE 283
*STB? 283
*TRG 284
*TST? 284
*WAI 284
E4991A GPIB command 286
ABOR 286
AVER 287
AVER:COUN 288
CALC:AVER 289
CALC:AVER:CLE 289
CALC:AVER:COUN 290
CALC:BMON 291
CALC:DATA:MON? 292
CALC{1-5}:DATA? 293
CALC{1-5}:DATA:EPAR 294
CALC{1-5}:EPAR 295
CALC{1-5}:EPAR:CIRC 296

CALC{1-5}:EPAR:SIM 297
CALC{1-5}:FORM 298
CALC:FORM:PAR:DIE 300
CALC{1-3}:FORM:PAR:EPH 301
CALC:FORM:PAR:MAG 302
CALC{1-5}:FORM:UNIT:ANGL 303
CALC{1-5}:MARK{1-8} 304
CALC{1-5}:MARK{1-8}:ACT 305
CALC{1-5}:MARK:AOFF 305
CALC{1-5}:MARK:APE:SET 306
CALC{1-5}:MARK:APE:EXC:X 307
CALC{1-5}:MARK:APE:EXC:Y 308
CALC:MARK:COUP 309
CALC{1-5}:MARK:DISC 309
CALC{4-5}:MARK:FORM 310
CALC{1-5}:MARK:FUNC 311
CALC{1-5}:MARK:FUNC:DOM 312
CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM 313
CALC{1-5}:MARK:FUNC:DOM:LIM:ALL 314
CALC{1-5}:MARK:FUNC:DOM:LIM:ALL:RES? 315
CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:LOW 316
CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:RES? 317
CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:UP 318
CALC{1-5}:MARK:FUNC:DOM:SPAN 319
CALC{1-5}:MARK:FUNC:DOM:STAR 320
CALC{1-5}:MARK:FUNC:DOM:STOP 320
CALC{1-5}:MARK:FUNC:EXEC 321
CALC{1-5}:MARK:FUNC:EXEC:LEFT 322
CALC{1-5}:MARK:FUNC:EXEC:NEXT 322
CALC{1-5}:MARK:FUNC:EXEC:RIGH 323
CALC{1-5}:MARK:FUNC:TARG 324
CALC{1-5}:MARK:FUNC:TRAC 325
CALC{1-5}:MARK:LIST 326
CALC{1-5}:MARK:ON 327
CALC{1-5}:MARK:REF 328
CALC{1-5}:MARK:REF:ACT 329
CALC{1-5}:MARK:REF:FUNC:DOM:LIM 329
CALC{1-5}:MARK:REF:FUNC:DOM:LIM:LOW 330
CALC{1-5}:MARK:REF:FUNC:DOM:LIM:RES? 331
CALC{1-5}:MARK:REF:FUNC:DOM:LIM:UP 332
CALC{1-5}:MARK:REF:TYPE 333
CALC{1-5}:MARK:REF:X 334
CALC{1-5}:MARK:REF:Y 335
CALC{1-5}:MARK:SET 336
CALC{1-5}:MARK:UNIT 337

CALC{1-5}:MARK{1-8}:X 338
CALC{1-5}:MARK{1-8}:Y? 339
CALC{1-5}:MATH:FUNC 340
CALC{1-5}:MATH:MEM 341
CALC{1-3}:MATH:OFFS 342
CALC{1-5}:MST 343
CALC{1-5}:MST:DATA? 344
DATA:CAD{1-8}? 345
DATA:CCO{1-6} 346
DATA:CMD{1-2}? 347
DATA:CMP{1-3} 348
DATA:RAW? 349
DATA:SEGM{1-16}:CAD{1-8}? 350
DATA:SEGM{1-16}:CCO{1-6} 351
DATA:SEGM{1-16}:CMD{1-2}? 352
DATA:SEGM{1-16}:CMP{1-3} 353
DISP:BACK 354
DISP:ENAB 354
DISP:FORM 355
DISP:TEXT 355
DISP:TEXT{1-3}:SET 356
DISP:TRAC{1-5} 356
DISP:TRAC{1-5}:GRAT:FORM 357
DISP:TRAC{1-3}:REF 358
DISP:TRAC{1-5}:SEL 358
DISP:TRAC{1-5}:TEXT 359
DISP:TRAC{1-5}:TEXT:PAGE 359
DISP:TRAC{1-5}:TITL 360
DISP:TRAC{1-5}:TITL:DATA 361
DISP:TRAC{4-5}:X:RLEV 362
DISP:TRAC{1-5}:X:SPAC 363
DISP:TRAC{1-5}:Y:AUTO 364
DISP:TRAC:Y:AUTO:ALL 364
DISP:TRAC{1-3}:Y:BOTT 365
DISP:TRAC{1-5}:Y:FOR 366
DISP:TRAC{1-5}:Y:FULL 367
DISP:TRAC{1-5}:Y:PDIV 368
DISP:TRAC{1-5}:Y:RLEV 369
DISP:TRAC{1-3}:Y:RPOS 370
DISP:TRAC{1-3}:Y:SPAC 371
DISP:TRAC{1-3}:Y:TOP 372
FORM:BORD 373
FORM:DATA 374
FREQ 375
FREQ:CENT 376

FREQ:SPAN 377
FREQ:SPAN:FULL 377
FREQ:STAR 378
FREQ:STOP 379
HCOP 380
HCOP:ABOR 380
HCOP:CONT 380
HCOP:IMAG 381
INIT 382
INIT:CONT 382
MMEM:CAT? 383
MMEM:CDIR 383
MMEM:COPY 384
MMEM:DEL 384
MMEM:LOAD 385
MMEM:LOAD:MACR 385
MMEM:LOAD:TRAC 386
MMEM:MDIR 386
MMEM:MOVE 387
MMEM:RDIR 388
MMEM:STOR 388
MMEM:STOR:CITI{1-3} 389
MMEM:STOR:GRAP 389
MMEM:STOR:GRAP:BMP 390
MMEM:STOR:MACR 390
MMEM:STOR:TRAC 391
MMEM:STOR:TRAC:ASC 391
MMEM:STOR:TRAC:SEL{1-4} 392
MODE 393
PROG:CAT? 394
PROG:NAME 394
PROG:STAT 395
PROG:WAIT 395
SEGM{1-16}:AVER:COUN 396
SEGM:COUN 397
SEGM{1-16}:CURR 398
SEGM:CURR:OFFS:STAT 399
SEGM{1-16}:CURR:LIM 400
SEGM{1-16}:CURR:OFFS 401
SEGM:CURR:STAT 402
SEGM{1-16}:DATA 403
SEGM:DATA:ALL 405
SEGM:DEL:ALL 406
SEGM{1-16}:FREQ:CENT 407
SEGM{1-16}:FREQ:SPAN 408

SEGM{1-16}:FREQ:STAR 409
SEGM{1-16}:FREQ:STOP 410
SEGM{1-16}:POW 411
SEGM:POW:STAT 412
SEGM{1-16}:SWE:POIN 413
SEGM{1-16}:VOLT 414
SEGM{1-16}:VOLT:LIM 415
SEGM{1-16}:VOLT:OFFS 416
SEGM:VOLT:OFFS:STAT 417
SEGM:VOLT:STAT 418
SENS:CORR1 419
SENS:CORR1:CKIT 420
SENS:CORR1:CKIT:LIST 421
SENS:CORR1:CKIT:STAN1:C 422
SENS:CORR1:CKIT:STAN1:G 423
SENS:CORR1:CKIT:STAN1:LIST:B 424
SENS:CORR1:CKIT:STAN1:LIST:G 425
SENS:CORR1:CKIT:STAN2:L 426
SENS:CORR1:CKIT:STAN2:LIST:R 427
SENS:CORR1:CKIT:STAN2:LIST:X 428
SENS:CORR1:CKIT:STAN2:R 429
SENS:CORR1:CKIT:STAN3:L 430
SENS:CORR1:CKIT:STAN3:LIST:R 431
SENS:CORR1:CKIT:STAN3:LIST:X 432
SENS:CORR1:CKIT:STAN3:R 433
SENS:CORR1:CKIT:STAN7:PLF 434
SENS:CORR1:CKIT:STAN7:PRE 435
SENS:CORR1:CKIT:STAN7:THIC 436
SENS:CORR1:COLL 437
SENS:CORR1:COLL:FPO 438
SENS:CORR1:COLL:SAVE 439
SENS:CORR2:CKIT:LIST 440
SENS:CORR2:CKIT:STAN1:C 441
SENS:CORR2:CKIT:STAN1:G 442
SENS:CORR2:CKIT:STAN1:LIST:B 443
SENS:CORR2:CKIT:STAN1:LIST:G 444
SENS:CORR2:CKIT:STAN2:L 445
SENS:CORR2:CKIT:STAN2:LIST:R 446
SENS:CORR2:CKIT:STAN2:LIST:X 447
SENS:CORR2:CKIT:STAN2:R 448
SENS:CORR2:COLL 449
SENS:CORR2:COLL:FPO 450
SENS:CORR2:COLL:OPEN 451
SENS:CORR2:COLL:SAVE 451
SENS:CORR2:COLL:SHOR 452

SENS:CORR2:EDEL:TIME 453
SENS:CORR2:FIXT 454
SENS:CORR2:FIXT:EDEL:MODE:DIST? 455
SENS:CORR2:FIXT:EDEL:USER:DIST 456
SOUR:CURR 457
SOUR:CURR:CENT 458
SOUR:CURR:LIM:OFFS 459
SOUR:CURR:MODE 460
SOUR:CURR:OFFS 461
SOUR:CURR:OFFS:CENT 462
SOUR:CURR:OFFS:SPAN 463
SOUR:CURR:OFFS:STAR 464
SOUR:CURR:OFFS:STAT 465
SOUR:CURR:OFFS:STOP 466
SOUR:CURR:SPAN 467
SOUR:CURR:STAR 468
SOUR:CURR:STOP 469
SOUR:POW 470
SOUR:POW:CENT 471
SOUR:POW:MODE 472
SOUR:POW:SPAN 473
SOUR:POW:STAR 474
SOUR:POW:STOP 475
SOUR:VOLT 476
SOUR:VOLT:CENT 477
SOUR:VOLT:LIM:OFFS 478
SOUR:VOLT:MODE 479
SOUR:VOLT:OFFS 480
SOUR:VOLT:OFFS:CENT 481
SOUR:VOLT:OFFS:SPAN 482
SOUR:VOLT:OFFS:STAR 483
SOUR:VOLT:OFFS:STAT 484
SOUR:VOLT:OFFS:STOP 485
SOUR:VOLT:SPAN 486
SOUR:VOLT:STAR 487
SOUR:VOLT:STOP 488
STAT:OPER? 489
STAT:OPER:COND? 489
STAT:OPER:ENAB 490
STAT:OPER:NTR 491
STAT:OPER:PTR 492
STAT:PRES 493
STAT:QUES? 493
STAT:QUES:COND? 493
STAT:QUES:ENAB 494

STAT:QUES:HARD? 495
STAT:QUES:HARD:COND? 495
STAT:QUES:HARD:ENAB 496
STAT:QUES:HARD:NTR 497
STAT:QUES:HARD:PTR 498
STAT:QUES:LIM? 499
STAT:QUES:LIM:COND? 499
STAT:QUES:LIM:ENAB 500
STAT:QUES:LIM:NTR 501
STAT:QUES:LIM:PTR 502
STAT:QUES:NTR 503
STAT:QUES:PTR 504
STAT:QUES:SEAR? 504
STAT:QUES:SEAR:COND? 505
STAT:QUES:SEAR:ENAB 505
STAT:QUES:SEAR:NTR 506
STAT:QUES:SEAR:PTR 507
SWE:DIR 508
SWE:DWEL1 508
SWE:DWEL2 509
SWE:DWEL3 510
SWE:POIN 511
SWE:STIM{1-4}? 512
SWE:TIME 513
SWE:TIME:AUTO 514
SWE:TYPE 515
SYST:BEEP 516
SYST:BEEP:STAT 516
SYST:DATE 517
SYST:ERR? 517
SYST:ERR:COUN? 518
SYST:EXTR? 518
SYST:IND:POIN:SET 519
SYST:IND:SWE:SET 519
SYST:IND:TIME 520
SYST:IND:TIME:SET 521
SYST:KLOC 522
SYST:KLOC:KBD 522
SYST:KLOC:MOUS 523
SYST:POFF 523
SYST:PRES 523
SYST:TIME 524
SYST:VERS? 524
TRIG 525
TRIG:EVEN 525

TRIG:SLOP 526
TRIG:SOUR 526
COM Interface Reference 527
Conventions of COM Interface 528
Explanation 528
VB Syntax 528
Parameter 528
Response 529
Examples 529
Application object 530
Name property 530
VBAVersion property 530
Connection property 531
SingleMeasure method 532
CalMeasure method 533
CompenMeasure method 534
GetTextData method 535
GetScreenImage method 535
WaitForEvent method 536
SweepEnd event 537
SweepStart event 538
CompleteSweepAveraging event 538
Unlocked event 539
DcBiasOverload event 539
RfOverload event 540
SCPI object 541
Name property 541
Enter method 542
Output method 543
Query method 543
How to read array data 544
Option parameters offered in Enter method 544
Not specifying option parameter 544
Specifying option parameters 546
Manual Changes 549
Manual Changes 550
Change 1 550
Change 2 552
GPIB Status Report System 555
General Model of Status Registers 556
Event Registers 557
Enable Registers 557
Status Byte Register 558
Transition Filter and Condition Register 559
Status Register Structure 560

GPIB Command List By Function 569
GPIB Command List By Function 570
Table of corresponding 4291B vs. E4991A GPIB commands 581
Table of Corresponding GPIB Commands 582
Complex Operation Programs 601
Complex Operation Programs 602
Sample Implementation in Visual Basic 602
Sample Implementation in HTBasic 603
List of Responses to Measurement Failure 605
Behavior under Abnormal Measurement Conditions 606
Messages 607
Order of Error Number 608
Messages indicating the internal status of the equipment 620
Messages indicating the measurement failure 620
Messages indicating the results of processing (elapsing) 621

1 To Make Effective Use of This Manual

This chapter describes the contents of this programming manual and how to use it.

Contents of this manual

This is the programming manual of the E4991A RF Impedance/Material Analyzer. The contents of each chapter in this manual are as follows.

Chapter 1, “To Make Effective Use of This Manual”

This chapter describes the contents of this programming manual and how to use it.

Chapter 2, “Outline of Remote Control”

This chapter explains the system structures, required equipment, and set up methods needed to structure the remote control system of the E4991A.

Chapter 3, “Setting Measurement Conditions”

This chapter explains how to set the measurement conditions of the Agilent E4991A.

Chapter 4, “Preparation for Accurate Measurement”

This chapter explains how to perform calibration as well as electrical length and fixture compensation for the Agilent E4991A.

Chapter 5, “Measurement Start and Detection of Measurement End”

This chapter explains how to prepare a trigger for starting measurement and detecting the end of measurement with the Agilent E4991A.

Chapter 6, “Read and Write Measurement Data”

This chapter explains how to read and write Agilent E4991A measurement data.

Chapter 7, “Measurement Result Processing”

This chapter explains how to process measurement results by using the Agilent E4991A’s marker function and equivalent circuit analysis function.

Chapter 8, “Save and Recall Files”

This chapter explains how to save the Agilent E4991A’s measurement condition settings or measurement results to a file and how to later recall them from the file.

Chapter 9, “Using Printer”

This chapter explains how to use a printer connected to the Agilent E4991A to print out measurement results and other information from the instrument.

Chapter 10, “Setting the Display”

This chapter explains how to set the display screen of the Agilent E4991A.

Chapter 11, “Error Handling”

This chapter describes how the Agilent E4991A handles errors in program execution.

Chapter 12, “Shutting Down the Instrument”

This chapter explains how to properly shut down the Agilent E4991A.

Chapter 13, “Use of Macros”

This chapter explains how to use the macro function of the Agilent E4991A to create macro programs with the Visual Basic editor. Information is also given on how to execute produced macros.

Chapter 14, “Outline of Programming Using COM”

This chapter gives the required information for programming with the COM interface of the Agilent E4991A. For more basic information on the COM interface, refer to Chapter 18, “COM Interface Reference.”

Chapter 15, “Controlling Peripherals”

This chapter explains how to control peripherals connected to the Agilent E4991A by using the software (VISA) installed in the instrument.

Chapter 16, “Application Programs”

This chapter gives measurement examples (sample programs) using the HTBasic program and the instrument’s macro program (E4991A VBA).

Chapter 17, “GPIB Command Reference”

This chapter provides the GPIB command reference of the Agilent E4991A. The command references are written in abbreviated form and listed in alphabetic order.

Chapter 18, “COM Interface Reference”

This chapter gives COM interface references of the Agilent E4991A classified according to object.

Appendix A, “Manual Changes”

This appendix contains the information required to adapt this manual to versions or configurations of the Agilent E4991A manufactured earlier than the current printing date of this manual. The information contained elsewhere in this manual applies directly to E4991A units bearing the serial number printed on this manual’s title page.

Appendix B, “GPIB Status Report System”

This appendix describes the status report system in the Agilent E4991A GPIB system.

Appendix C, “GPIB Command List By Function”

This appendix lists the Agilent E4991A GPIB commands according to function.

Appendix D, “Table of corresponding 4291B vs. E4991A GPIB commands”

This appendix lists each Agilent E4991A GPIB command along with its corresponding Agilent 4291B GPIB command. Note that the simple commands prepared for the 4291B do not have equivalent E4991A commands.

Appendix E, “Complex Operation Programs”

This appendix shows sample programs for implementing complex operations in Visual Basic and HTBasic.

Appendix F, “List of Responses to Measurement Failure”

This appendix lists the Agilent E4991A’s responses to various types of measurement failure.

Appendix G, “Messages”

The Agilent E4991A provides error messages as well as messages that indicate the internal operating status of the equipment. This appendix describes such messages in order of error number. To search for E4991A error messages in alphabetical order, please refer to the Operation Manual.

How to use this manual

When writing programs, it is not necessarily required to use all the information in this manual. Basically, the structure of remote control system that the user decides will determine required equipment, programming language that is necessary to understand, and command set to control the E4991A.

Selecting the structure of remote control system

First, select the remote control system to suit the purpose from the following remote control system structures, and read this manual according to the contents written there.

1. Manual operation

   Operating the E4991A through the front panel of the E4991A or keyboard/mouse. This doesn't suit the measurement of complex setting combination while it doesn't require the preparation of external controller separately or the knowledge of programming to control the E4991A. Refer to the operation manual for how to operate E4991A through the front panel or keyboard/mouse.

2. Manual operation using remote user interface function

   If remote user interface function is used, it becomes possible to operate the E4991A from Personal Computer by providing the environment of the E4991A user interface (keyboard/mouse connected to the E4991A) for the Personal Computer connected to the E4991A on LAN. Refer to the operation manual for the set-up and usage of remote user interface function.

3. GPIB remote control system

   The E4991A can be controlled from external controller (for example, computers like a Personal Computer, Work Station, etc.) through GPIB interface. The outline of the system is explained in "Outline of GPIB remote control system" on page 26.

4. Remote control using macros in the E4991A

   The E4991A and peripheral equipment can be controlled by using the macros (Visual Basic for Application) which is installed in the E4991A. The outline of the system is explained in "Remote control using E4991A macros" on page 32.

5. Remote control using remote user interface function and application software.

   The E4991A can be controlled from the Personal Computer that is connected to the E4991A by the remote user interface function, using application software (Microsoft Visual Basic, and etc.). The outline of the system is explained in "Remote control using remote user interface function and application software" on page 35.

Sample programs

The sample program disk (Agilent Parts No. E4991-180x0) and CD-ROM (Agilent Parts No. E4991-905x0) contain HTBasic sample programs and E4991A VBA sample programs shown in this manual. These sample program disks are DOS formatted.

How to load the sample program

To use the sample program on HTBasic, load it by GET command on HTBasic. The following is an example of loading a sample program, "setup.htb".

GET "setup.htb"

To use the sample program on the E4991A VBA which file extension is *.lcr, load the macro program after the following front panel operation from the E4991A.

Utility - Load Program...

Or, to use the sample program on the E4991A VBA which file extension is *.bas or *.cls, import the macro program from the Visual Basic Editor.

2 Outline of Remote Control

This chapter explains the system structures, required equipment, and set up methods needed to structure the remote control system of the E4991A.

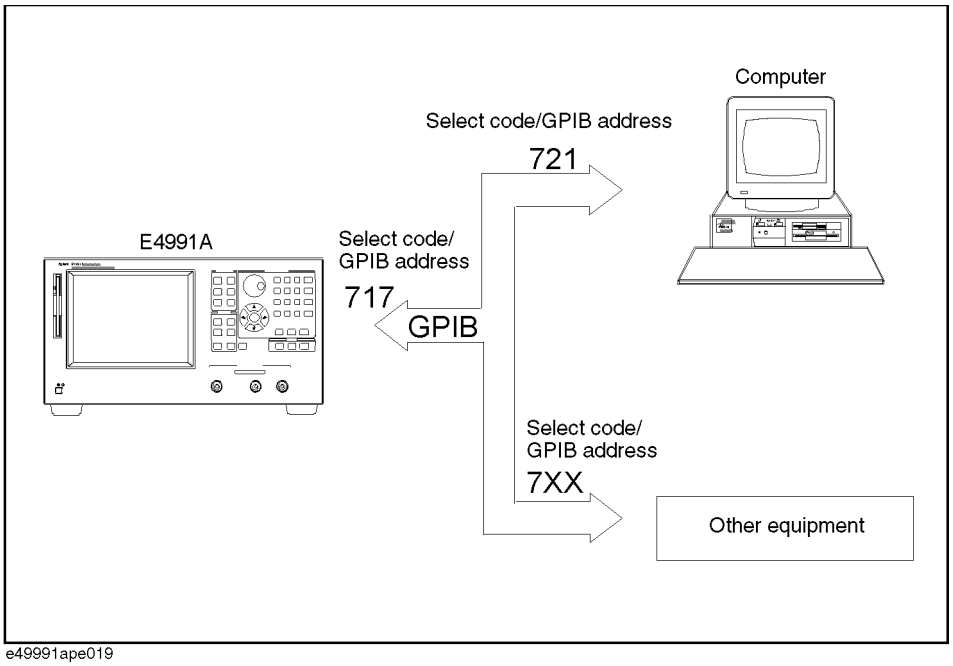
Outline of GPIB remote control system

This section explains the system structures and required equipment for sending GPIB command messages. In Chapter 17, you can also find more on the GPIB commands used to control the E4991A from an external computer through the GPIB interface.

System structure

Connect the E4991A to an external computer and peripheral equipment with a GPIB cable. Figure 2-1 outlines the system structure for the GPIB remote control system.

Figure 2-1 **Structure example of GPIB remote control system**



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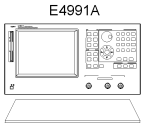
What is GPIB?

GPIB (General-Purpose Interface Bus) is an interface standard for connecting computers and peripheral equipment. It supports worldwide standards such as IEEE 488.1, IEC-625, IEEE 488.2 and JIS-C1901. By using the GPIB interface, the E4991A can be controlled from an external computer. The computer sends commands and instructions to the E4991A and receives data sent from it through GPIB.

Required equipment

1. The Agilent E4991A RF Impedance/Material Analyzer and the accessories required to measure a DUT



It is not necessary to select the system-controller mode or the addressable-only mode of the GPIB system. The E4991A is automatically set to appropriate mode by the controller when the GPIB program is run.

a. Set the GPIB address of the E4991A.

System - **GPIB Setup...** - E4991A Address: (drop-down box)

b. Turn the E4991A's main power off and then back on again.

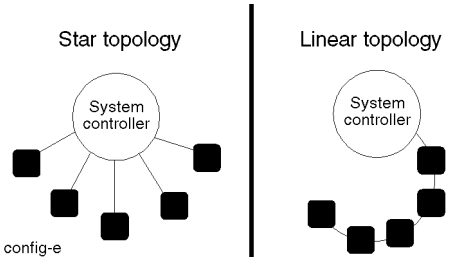
2. GPIB system controller

To use an external computer as the system controller, a Personal Computer (IBM compatible) or work station with a GPIB interface is required. Also, software such as Agilent VEE, Microsoft Visual Basic, or HTBasic is required to control the E4991A through GPIB.

3. Peripheral equipment depending on the user's purpose
4. GPIB cable (10833A/B/C/D) to connect the computer to the E4991A and peripheral equipment

The sizes and configurations of possible GPIB systems

- A maximum of 15 devices can be connected to one GPIB system.
- Keep the length of cable between devices within 1 m. The total length of connecting cable in a single GPIB system should not exceed 2 m × the number of connected devices (the controller is counted as one device). Also, you cannot construct a system having more than 20 m in total cable length.
- The number of connectors on a single device should not exceed 4. More than that will cause strain on the connector parts, which could lead to equipment breakdown.
- The pattern of connection can be star topology, linear topology or a combination of both. However, loop topology cannot be used.



Controller

The device that allows talk (data output) or listen (data receipt) by the GPIB device is called the controller.

An active controller can control other devices on the bus (if multiple controllers are connected). Only one controller can be active at any one time. By executing the pass control, the active controller can pass the controlling right to another controller (pass control function).

NOTE When the E4991A is used in system controller mode, the controlling right cannot be passed to another controller or cannot be received from another computer because the E4991A does not support the pass control function.

Device selector

Device control of GPIB is performed by sending a command by the active controller. The active controller can choose the target device by specifying the device selector.

Sending GPIB command messages

Learning about GPIB commands

To find information on a particular GPIB command, refer to the following sections in this book.

- The procedures used to write basic programs for the E4991A are explained from Chapter 2 to Chapter 11. Program examples using HTBasic are also given.
- Appendix C, “GPIB Command List By Function,” on page 569 provides a convenient list of GPIB commands according to the measurement or general-purpose functions they perform.
- “List of Functions by Menu” in the *Operation Manual* shows the correspondence of GPIB Commands to the front panel operation of the E4991A.
- Chapter 16, “Application Programs,” on page 253 shows E4991A application examples produced by using HTBasic.
- Chapter 17, “GPIB Command Reference,” on page 275 lists all of the GPIB commands used with the E4991A in alphabetical order.

Type and structure of commands

The GPIB commands that can be used with the E4991A are classified into the following two groups.

E4991A commands

These commands are unique to the E4991A. They cover all of the instrument’s measurement functions and some of its general-purpose functions. The commands in this group have a hierarchical structure called a command tree. Each command is structured by a character string (mnemonic) to indicate the hierarchy and uses a colon (:) as a divisional marker between hierarchical levels.

IEEE common commands

These are the commands used to cover the general purpose functions defined by IEEE488.2. These can be commonly used by measurement equipment that support this standard. The commands in this group always start with an asterisk (*). The commands in this group do not have a hierarchical structure.

The concept of command tree

The command at the highest-level position in the command tree hierarchy is called “root command” or simply “root.” To access a lower command in the tree structure’s hierarchy, a particular “path” has to be specified in the same way as a directory path in the DOS file system. The current path is set as “root” after the power is turned on or a reset is executed. Depending on the special symbols in the massage, the setting of the path changes as follows.

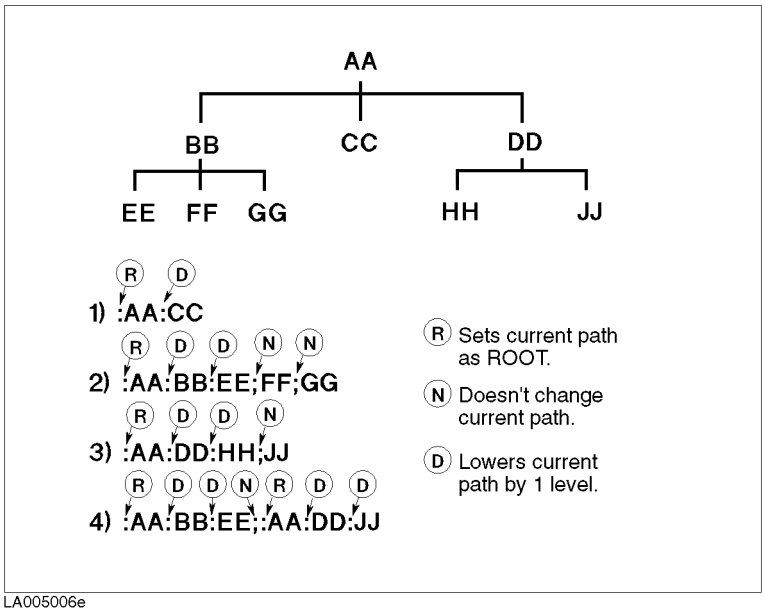
Message terminator
: A message terminator such as <new line> sets the current path as the “root.”

Colon (:)
: When a colon is located between two command mnemonics, the colon lowers the level of the current path on the command tree. When it is used as the first character of a command, it specifies the command mnemonic to follow it as the command of root level.

Semi-colon (;)
: A semi-colon divides two commands within one message without changing the current path.

Figure 2-2 shows an example of using the colon and semi-colon for efficient access of various commands within the command tree.

Figure 2-2 **Usage of colon and semi-colon**



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Grammar for massages

The grammar used for sending program messages by GPIB is described below. Program massage means a massage sent to the measurement equipment by the user through an external computer for controlling the measurement equipment. A program message contains one or more commands and the parameters required for them.

Handling of capital/small letters

No differentiation between capital and small letters

Program message terminator

Program messages have to end with any one of these three program message terminators: <new line>, <^END>, and <new line><^END>. <END> means that EOI becomes the active level on the GPIB interface when the immediately preceding data byte is sent out. For example, the OUTPUT command of HTBasic automatically sends the message terminator after the last data byte.

Parameter

A space (ASCII code 32) is required between a command and the first parameter. When multiple parameters are sent with one command, the parameters have to be divided by commas (,).

Message that includes multiple commands

When sending two or more commands in one message, the commands have to be divided by semi-colons (;). The following is an example of sending the ***CLS** command and the **INIT** command in the same massage by HTBasic.

```
OUTPUT 717;"*CLS;:INIT"
```

Remote mode

The E4991A doesn’t have a remote mode. Therefore, it doesn’t switch to remote mode even if it receives the relevant GPIB command. Also, there is no local key to release the remote mode.

When it is necessary to prevent operational error caused by mistaken input through the front panel or keyboard/mouse of the E4991A under remote control, use one of the following GPIB commands to lock the input device.

- **SYST:KLOC** on page 522 (locks front panel)
- **SYST:KLOC:KBD** on page 522 (locks keyboard)
- **SYST:KLOC:MOUS** on page 523 (locks mouse)

Remote control using E4991A macros

This section describes the system structures and command sets used for controlling the E4991A and peripheral equipment with the instrument's macro functions.

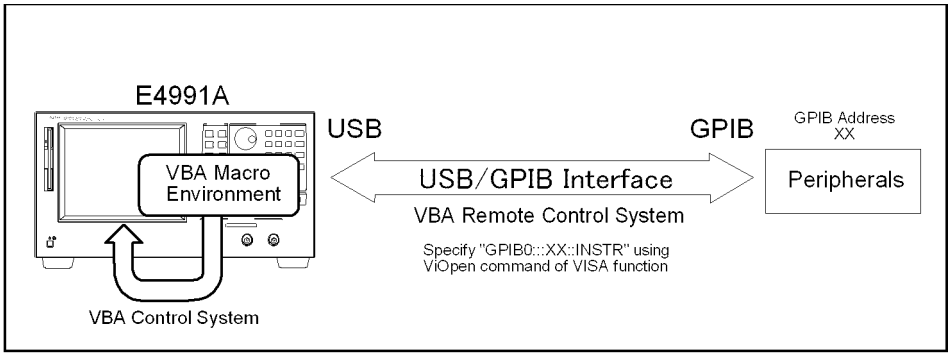
NOTE

The E4991A is shipped with a macro function. A macro allows you to automatically execute a series of multiple commands with a single command. Using a macro allows you to combine the steps of a complicated procedure into a single step for a wide variety of applications. A macro can also be used to control peripheral equipment. The E4991A VBA (Visual Basic for Application) is the programming language used to execute macro functions.

System structure

Connect the E4991A to any peripheral equipment that can be connected with a USB/GPIB cable. An outline of a remote control system using the macro functions is shown in Figure 2-3.

Figure 2-3 Structure example of GPIB remote control system



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Required equipment

1. The Agilent E4991A RF Impedance/Material Analyzer and the accessories required to measure a DUT
2. Peripheral equipment depending on the user's purpose
3. USB/GPIB interface(82357A).

NOTE To use the VBA remote control system, you need to set the USB/GPIB interface correctly. For detail, refer to Operation Manual.

NOTE Do not connect two or more USB/GPIB interfaces.

Size and configuration of possible GPIB systems

For information on the type of GPIB system that can be constructed for controlling peripheral equipment, refer to "The sizes and configurations of possible GPIB systems" on page 28.

How to operate macros

It is necessary to understand the basics of E4991A VBA, which is the programming language used for writing and executing macros. E4991A VBA is briefly explained in Chapter 13, "Use of Macros," on page 211. Refer to E4991A VBA help for more detailed information on the basics of E4991A VBA programming, standard control, and functions.

Sending command messages

When controlling the E4991A or peripheral equipment by macro functions, the command set differs depending on the target of control.

Commands to control E4991A

The command used to control the E4991A is written in the E4991A COM interface. The following two types of E4991A COM interfaces can be used. For combined use of the COM interface and a GPIB command provided by the E4991A, it is necessary to understand how to use the GPIB command.

- COM interface
- COM interface combined with GPIB command of the E4991A

For the basic method of using the E4991A COM interface, refer to Chapter 14, “Outline of Programming Using COM,” on page 237 and Chapter 18, “COM Interface Reference,” on page 527.

To find a GPIB command provided by the E4991A, refer to “Learning about GPIB commands” on page 29.

Commands to control peripheral equipment

The macro used to control peripheral equipment is written by using the VISA library.

For the basic method of using the functions provided by the VISA library, refer to Chapter 15 on page 245. For details on how to use the VISA library, refer to the on-line help for VISA (accessible by opening the file named visa.hlp on the supplied CD-ROM (Agilent Parts No. E4991-905x0)).

For how to use the GPIB commands of peripheral equipment, refer to the operation manual of the peripheral equipment.

Remote mode

Unlike previous Agilent models, the E4991A does not have a “Remote mode” that automatically locks up operation of the front panel’s hardkeys when it is controlled through E4991A COM object. If necessary, the E4991A’s front panel can be locked by a command.

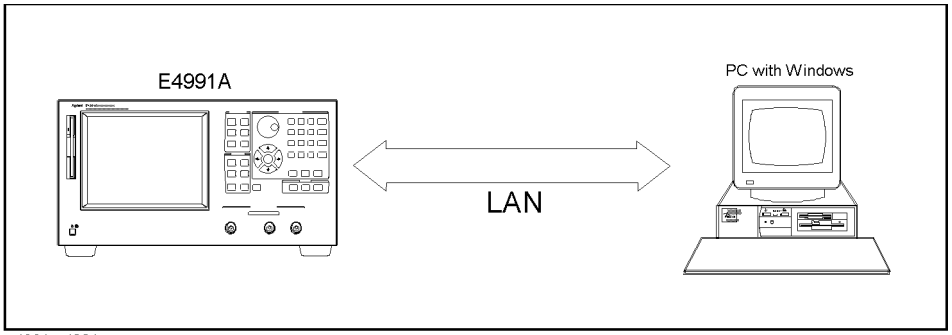
Remote control using remote user interface function and application software

This section explains the system structures and command sets for controlling the E4991A by using a macro (E4991A VBA) installed in your personal computer with the remote user interface function.

System structure

Connect the E4991A to a personal computer with a LAN cable. Figure 2-4 outlines the system structure for using the remote user interface function.

Figure 2-4 **Structure of remote control system using remote U/I function**



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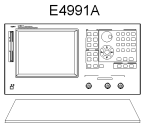
NOTE Refer to the *Operation Manual* for setup instructions of the E4991A remote user interface function.

NOTE Peripheral equipment connected to the E4991A through GPIB cannot be controlled.

Required equipment

1. The Agilent E4991A RF Impedance/Material Analyzer and the accessories required to measure a DUT



It is not necessary to select the system-controller mode or the addressable-only mode of the GPIB system.

2. Personal Computer

A personal computer (IBM compatible personal computer) with a LAN interface is required.

3. LAN cable to connect the E4991A and personal computer

How to use the application software

It is necessary to understand E4991A VBA in order to install and use the supplied E4991A VBA program on your personal computer. E4991A VBA is briefly explained in Chapter 13, “Use of Macros,” on page 211. Refer to E4991A VBA help for more detailed information on the basics of E4991A VBA programming, standard control, and functions.

NOTE Refer to the operation manual for instructions on installing the E4991A VBA program on your personal computer.

NOTE Agilent Technologies shall not guarantee operation of the E4991A COM if the customer uses application software other than E4991A VBA (Visual Basic for Application).

Sending command messages

Basically, the commands used to control the E4991A are written in the E4991A COM interface. The following two types of E4991A COM interfaces can be used. To use the COM interface in combination with the GPIB command offered by the E4991A, it is necessary to understand how to use GPIB command.

- COM interface
- COM interface combined with GPIB command

For the basic method of using the E4991A COM interface, refer to Chapter 14, “Outline of Programming Using COM,” on page 237 and Chapter 18, “COM Interface Reference,” on page 527.

To find a GPIB command provided by the E4991A, refer to “Learning about GPIB commands” on page 29.

Remote mode

Unlike previous Agilent models, the E4991A does not have a “Remote mode” that automatically locks up operation of the front panel’s hardkeys when it is controlled through E4991A COM object. If necessary, the E4991A’s front panel can be locked by a command.

3 Setting Measurement Conditions

This chapter explains how to set the measurement conditions of the Agilent E4991A.

Set Measurement Parameter

The measurement mode (Impedance/Magnetic/Dielectric measurement) and the display trace type (Scalar/Complex trace) determine the parameters available. The following section explains how to set the measurement parameters.

Measurement Mode

Selection

When material measurement is performed by using the E4991A with option 002 (Material Measurement), use the following GPIB command to set the measurement mode to magnetic measurement or dielectric measurement. The E4991A without Option 002 sets the measurement mode to impedance.

- **MODE** on page 393

Parameters for Material Measurement

Before dielectric material measurement can be performed, the following GPIB command must be used to set the thickness of the device under test.

- **CALC:FORM:PAR:DIE** on page 300

Before magnetic material measurement can be performed, the following GPIB command must be used to set the sizes (inner and outer diameters and height) of the device under test.

- **CALC:FORM:PAR:MAG** on page 302

Display Trace

The E4991A allows the user to display up to five traces. Use the following GPIB command to display a trace.

- **DISP:TRAC{1-5}** on page 356

Of the five traces, Traces 1-3 are for scalar traces and Traces 4 -5 are for complex traces.

Parameters for Scalar Trace

Measurement Parameters

Table 3-1 shows measurement parameters available for a scalar trace. Use the following GPIB command to specify a trace number (1, 2, or 3) and select measurement parameters. Note that up to three measurement parameters can be displayed at a time.

- **CALC{1-5}:FORM** on page 298

Table 3-1 Measurement Parameters for Scalar Trace

Measurement parameter	GPIB parameter	Description
|Z|	Z	Absolute value of impedance
|Y|	Y	Absolute value of admittance
Ls	LS	Equivalent serial inductance
Lp	LP	Equivalent parallel inductance
Cs	CS	Equivalent serial capacitance
Cp	CP	Equivalent parallel capacitance
Rs	RS	Equivalent serial resistance
Rp	RP	Equivalent parallel resistance
D	D	Dissipation factor
Q	Q	Quality factor (reciprocal of dissipation factor)
R	R	Serial resistance
X	X	Reactance
G	G	Conductance
B	B	Susceptance
θz	ZPH	Phase of impedance
θy	YPH	Phase of admittance
|Γ|	RC	Absolute value of reflection coefficient
θγ	RCPH	Phase of reflection coefficient
Γx	RCX	Real part of reflection coefficient
Γy	RCY	Imaginary part of reflection coefficient
|μr|	P	Absolute value of complex permeability*1
μr'	PRE	Real part of complex permeability*1
μr''	PLF	Imaginary part of complex permeability *1*1
tanδ(μ)	PLT	Magnetic loss tangent*1
|εr|	DC	Absolute value of complex permittivity*2

Table 3-1 Measurement Parameters for Scalar Trace

Measurement parameter	GPIB parameter	Description
εr'	DCR	Real part of complex permittivity*2
εr"	DCLF	Imaginary part of complex permittivity *1*2
tanδ(ε)	DCLT	Dielectric loss tangent*2

*1. Parameters selectable when the Magnetic Material measurement mode is selected.
*2. Parameters selectable when the Dielectric Material measurement mode is selected.

Display Format

Use the following GPIB command to set the display format to Rectangular format:

- **DISP:TRAC{1-5}:GRAT:FORM** on page 357

If the Rectangular format is selected, the following GPIB command can be used to set the Y-axis scale to either Liner or Log.

- **DISP:TRAC{1-3}:Y:SPAC** on page 371

Phase Display for Scalar Trace

When the measurement parameter is phase for a scalar trace, use the following GPIB commands to set the unit and to turn on/off expanded phase display.

Set Unit

Use the following GPIB command to set the unit (degree or radian) in which phase is displayed:

- **CALC{1-5}:FORM:UNIT:ANGL** on page 303

Expanded Phase Display

The following GPIB command can be used to turn on/off the expanded phase display (in which phases less than -180 degree and more than +180 degree are not folded):

- **CALC{1-3}:FORM:PAR:EPH** on page 301

Parameters for Complex Trace

Measurement parameters

Table 3-2 shows measurement parameters available for a complex trace. Use the following GPIB command to specify a trace number (4 or 5) and select measurement parameters. Note that up to two measurement parameters can be displayed at any one time.

- **CALC{1-5}:FORM** on page 298

Table 3-2 Measurement Parameters for Complex Trace

Measurement parameter	GPIB parameter	Description
Z	Z	Impedance
Y	Y	Admittance
Γ	RC	Reflection coefficient
μr	P	Complex permeability*1
εr	DC	Complex permittivity*2

*1. Parameters selectable when the Magnetic Material measurement mode is selected.
*2. Parameters selectable when the Dielectric Material measurement mode is selected.

Display Format

Table 3-3 shows display formats available for a complex trace. Use the following GPIB command to select a display format from Complex plane format, Polar format, Smith chart, or Admittance chart.

- **DISP:TRAC{1-5}:GRAT:FORM** on page 357

Table 3-3 Display Format for Complex Trace

Measurement parameters	Display format
Z,Y,μr,εr	Complex plane or Polar format
Γ	Complex plane format, Polar format, Smith chart, or Admittance chart

Set Sweep Conditions

The following section explains how to set the sweep conditions. The sweep condition is a common parameter to all of traces.

Select Sweep Parameter

The user must select a desired combination of a sweep parameter and a sweep type. E4991A provides the following combinations of four sweep parameters and three sweep types.

- Frequency sweep (Linear sweep)
- Frequency sweep (Log sweep)
- Frequency sweep (Segment sweep)
- Oscillator level sweep (Linear sweep)
- dc bias voltage sweep*1 (Linear sweep)
- dc bias current sweep*1 (Linear sweep)

Use the following GPIB command to select both sweep parameter and sweep type.

- **SWE:TYPE** on page 515

NOTE

Segment conditions must be set in the segment sweep table before the sweep type is set to Segment sweep. For details on how to create the segment sweep table, see “Combination of Several Sweep Conditions (Segment Sweep)” on page 64.

Set Number of Measurement Points

Use the following GPIB command to set the number of measurement points for one sweep.

- **SWE:POIN** on page 511

Set Sweep Direction

Use the following GPIB command to set the sweep direction to UP or DOWN.

- **SWE:DIR** on page 508

*1. Selectable when the E4991A has option 001 (dc bias function) installed.

Set Sweep Range

Sweep range can be set in two ways: by specifying the center value and span value of the sweep range or by specifying the sweep start value and sweep stop value. Use the following GPIB commands to set a sweep range.

NOTE When sweep start or stop values are changed, center and span values are also changed accordingly.

The E4991A provides a GPIB command to specify the sweep range for each sweep parameter.

Frequency Sweep (Linear/Log Sweep)

If frequency sweep is selected as the sweep parameter, use the following GPIB commands to set a sweep range.

Sweep parameter	Sweep range	GPIB command
Frequency sweep	Start value	**FREQ:STAR** on page 378
	Stop value	**FREQ:STOP** on page 379
	Center value	**FREQ:CENT** on page 376
	Span value	**FREQ:SPAN** on page 377
	Full span value	**FREQ:SPAN:FULL** on page 377

Oscillator Level Sweep

When oscillator level sweep is selected as the sweep parameter, note that the GPIB command used to set the sweep range depends on the unit in which an oscillator level is set (current/voltage/dBm). From the following table, select the appropriate GPIB commands to set the sweep range and to set the oscillator level mode to sweep mode.

Sweep parameter		Mode/sweep range	GPIB command
Oscillator level sweep	Set in current	Mode	**SOUR:CURR:MODE** on page 460
		Start value	**SOUR:CURR:STAR** on page 468
		Stop value	**SOUR:CURR:STOP** on page 469
		Center value	**SOUR:CURR:CENT** on page 458
		Span value	**SOUR:CURR:SPAN** on page 467
	Set in voltage	Mode	**SOUR:VOLT:MODE** on page 479
		Start value	**SOUR:VOLT:STAR** on page 487
		Stop value	**SOUR:VOLT:STOP** on page 488
		Center value	**SOUR:VOLT:CENT** on page 477
		Span value	**SOUR:VOLT:SPAN** on page 486
	Set in dBm	Mode	**SOUR:POW:MODE** on page 472
		Start value	**SOUR:POW:STAR** on page 474
		Stop value	**SOUR:POW:STOP** on page 475
		Center value	**SOUR:POW:CENT** on page 471
		Span value	**SOUR:POW:SPAN** on page 473

DC Bias Voltage Sweep

If dc bias voltage sweep is selected as the sweep parameter, use one of the following GPIB commands to set the sweep range.

Sweep parameter	Sweep range	GPIB command
dc bias voltage sweep	Start value	**SOUR:VOLT:OFFS:STAR** on page 483
	Stop value	**SOUR:VOLT:OFFS:STOP** on page 485
	Center value	**SOUR:VOLT:OFFS:CENT** on page 481
	Span value	**SOUR:VOLT:OFFS:SPAN** on page 482

After setting up a sweep range, use the following GPIB command to set the dc bias current limit maximum value.

- **SOUR:CURR:LIM:OFFS** on page 459

Use the following GPIB command to turn on or off the dc bias output. When the dc bias output is turned on from off, the sweep mode is automatically set to hold mode.

- **SOUR:VOLT:OFFS:STAT** on page 484

DC Bias Current Sweep

If dc bias current sweep is selected as a sweep parameter, use one of the following GPIB commands to set the sweep range.

Sweep parameter	Sweep range	GPIB command
dc bias current sweep	Start value	**SOUR:CURR:OFFS:STAR** on page 464
	Stop value	**SOUR:CURR:OFFS:STOP** on page 466
	Center value	**SOUR:CURR:OFFS:CENT** on page 462
	Span value	**SOUR:CURR:OFFS:SPAN** on page 463

After setting the sweep range, use the following GPIB command to set the maximum value of the dc bias voltage limit.

- **SOUR:VOLT:LIM:OFFS** on page 478

Use the following GPIB command to turn on or off the dc bias output. When the dc bias output is turned on from off, the sweep mode is automatically set to hold mode.

- **SOUR:CURR:OFFS:STAT** on page 465

Set Sweep Time

Use the following GPIB command to select whether the sweep time is set to automatic setting or manual setting. If automatic setting is selected, this sets the shortest sweep time from among all of the E4991A pre-defined sweep times.

- **SWE:TIME:AUTO** on page 514

If manual setting is selected, use the following GPIB command to perform sweep within the specified sweep time.

- **SWE:TIME** on page 513

Set Delay Time

The delay time can be set at the sweep start or at each measurement point, if necessary.

Set Sweep Delay Time at Sweep Start

The following GPIB command can be used to delay the sweep start by the specified time. Note that when the sweep time is set to automatic setting, the delay time at the sweep start is set to 0 second.

- **SWE:DWEL1** on page 508

Set Delay Time at Each Measurement Point

The following GPIB command can be used to delay the measurement at each measurement point by the specified time. Note that when the sweep time is set to automatic setting, the delay time at each measurement point is set to 0 second.

- **SWE:DWEL2** on page 509

Set Delay Time at Each Segment (only segment sweep)

The following GPIB command can be used to delay the sweep start for each segment by the specified time. Note that when the sweep time is set to automatic setting, the delay time at each segment is set to 0 second.

- **SWE:DWEL3** on page 510

Set Frequency Span (only segment sweep)

The following GPIB command can be used to select whether a frequency span during segment sweep is displayed for each segment or the minimum and maximum frequencies are selected from all segments. The new span between the minimum and maximum frequencies is displayed as a frequency span during segment sweep.

- **DISP:TRAC{1-5}:X:SPAC** on page 363

Set Measurement Source

The following section explains how to set a measurement source. The measurement source is a parameter common to all of the traces.

Set Source

Set CW Frequency

If the sweep parameter is set to oscillator level sweep, dc bias voltage sweep, or dc bias current sweep, use the following GPIB command to set the CW frequency.

- **FREQ** on page 375

Set Oscillator Level

If the sweep parameter is set to frequency sweep, dc bias voltage sweep, or dc bias current sweep, note that the GPIB command used to set the oscillator level depends on the unit in which the oscillator level is set (current/voltage/power). Select the appropriate GPIB commands to set the oscillator mode to fixed mode and to set an output level value.

Oscillator level	Parameter to be set	GPIB command
Set in voltage	Mode	**SOUR:VOLT:MODE** on page 479
	Output level value	**SOUR:VOLT** on page 476
Set in current	Mode	**SOUR:CURR:MODE** on page 460
	Output level value	**SOUR:CURR** on page 457
Set in power (dBm)	Mode	**SOUR:POW:MODE** on page 472
	Output level value	**SOUR:POW** on page 470

Set DC Bias (DC Bias Function)

If the sweep parameter is set to frequency sweep or oscillator level sweep, the following GPIB command can be used to apply the dc bias to the DUT in either fixed voltage or current source mode.

Set in Fixed Voltage Source Mode

Output mode	Parameter to be set	GPIB command
Fixed voltage source	Output voltage level	**SOUR:VOLT:OFFS** on page 480
	Current limit maximum value	**SOUR:CURR:LIM:OFFS** on page 459

Use the following GPIB command to turn on or off the dc bias output. Note that when the dc bias is turned on from off, the sweep mode is automatically set to hold mode.

- **SOUR:VOLT:OFFS:STAT** on page 484

Set in Fixed Current Source Mode

Output mode	Parameter to be set	GPIB command
Fixed current source	Output current level	**SOUR:CURR:OFFS** on page 461
	Voltage limit maximum value	**SOUR:VOLT:LIM:OFFS** on page 478

Use the following GPIB command to turn on or off the dc bias output. Note that when the dc bias is turned on from off, the sweep mode is automatically set to hold mode.

- **SOUR:CURR:OFFS:STAT** on page 465

DC Bias Monitor Function

The following GPIB command can be used to display a dc bias monitor value.

- **CALC:BMON** on page 291

NOTE The dc bias monitor value displayed on the screen is that of the stimulus at an active marker position. Therefore, the marker must be turned on and the marker must be set to the specified stimulus value before the dc bias monitor function can be used.

Set Averaging

The E4991A has two types of averaging functions: sweep averaging and point averaging (Figure 3-1).

Sweep Averaging

Use the following GPIB command to turn sweep averaging on or off.

- **CALC:AVER** on page 289

After enabling sweep averaging, use the following GPIB command to set the averaging factor.

- **CALC:AVER:COUN** on page 290

The following GPIB command can be used to restart the sweep.

- **CALC:AVER:CLE** on page 289

Point Averaging

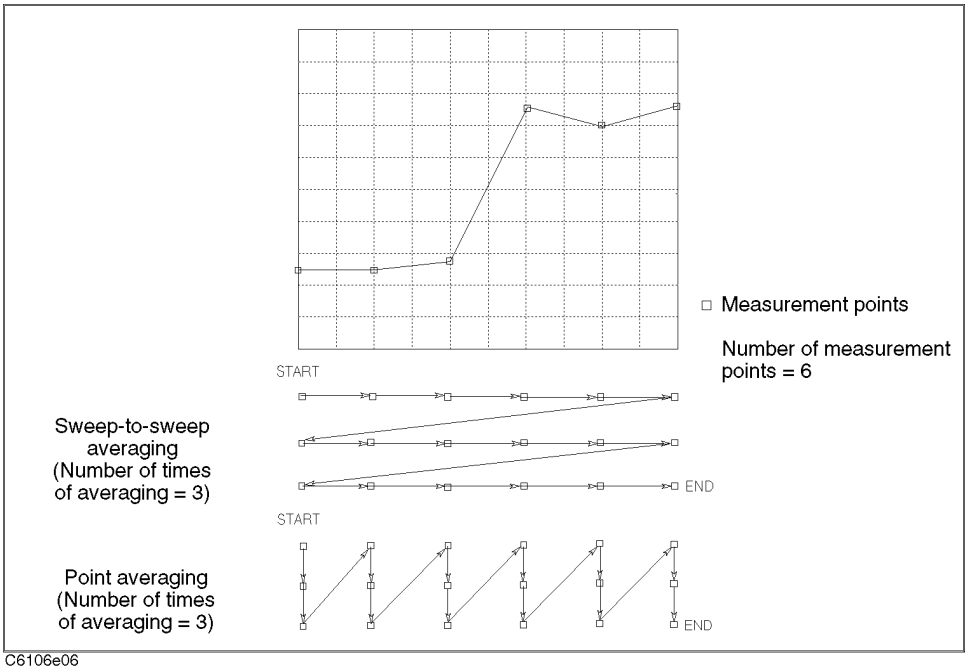
Use the following GPIB command to turn point averaging on or off.

- **AVER** on page 287

After enabling point averaging, use the following GPIB command to set the averaging factor.

- **AVER:COUN** on page 288

Figure 3-1 Sweep Averaging and Point Averaging



Set Display Scale

When the measurement screen is set to display a graph, the display scale for the specified trace can be set automatically to the most appropriate value or can be set manually to a desired value.

Select Trace for Which Scale Is Set

If both data and memory traces are displayed on the screen, use the following GPIB command to select the trace (data trace, memory trace, or both traces) for which the scale is to be set.

- **DISP:TRAC{1-5}:Y:FOR** on page 366

Automatic Scale Adjustment

When a trace goes out of the scale range, use the following GPIB command to adjust the scale automatically so that the trace stays within the scale range.

- **DISP:TRAC{1-5}:Y:AUTO** on page 364
- **DISP:TRAC:Y:AUTO:ALL** on page 364

Manual Setting of Scale

In addition to automatic scale adjustment, the E4991A provides a way to manually set the scale values. As shown in Figure 3-2, scale parameters depend on the display format of a trace.

Linear Y-Axis Format

The display scale can be set in two ways: by using full-scale and reference values or by using maximum and minimum values. Use the following GPIB commands to set the scale parameters.

Display format	Parameter to be set	GPIB command
Linear Y-axis format (Using max and min values)	Maximum value	**DISP:TRAC{1-3}:Y:TOP** on page 372
	Minimum value	**DISP:TRAC{1-3}:Y:BOTT** on page 365
	Reference line's position	**DISP:TRAC{1-3}:Y:RPOS** on page 370
Linear Y-axis format (Using full-scale)	Full-scale value	**DISP:TRAC{1-5}:Y:FULL** on page 367
	Reference line's value	**DISP:TRAC{1-5}:Y:RLEV** on page 369
	Reference line's position	**DISP:TRAC{1-3}:Y:RPOS** on page 370

Log Y-Axis Format

Use the following GPIB commands to set the maximum and minimum values of the scale.

Display format	Parameter to be set	GPIB command
Log Y-axis format	Maximum value	**DISP:TRAC{1-3}:Y:TOP** on page 372
	Minimum value	**DISP:TRAC{1-3}:Y:BOTT** on page 365

Polar Format

Use the following GPIB command to set the scale value of the outermost circle.

- **DISP:TRAC{1-5}:Y:FULL** on page 367

Complex Plane Format

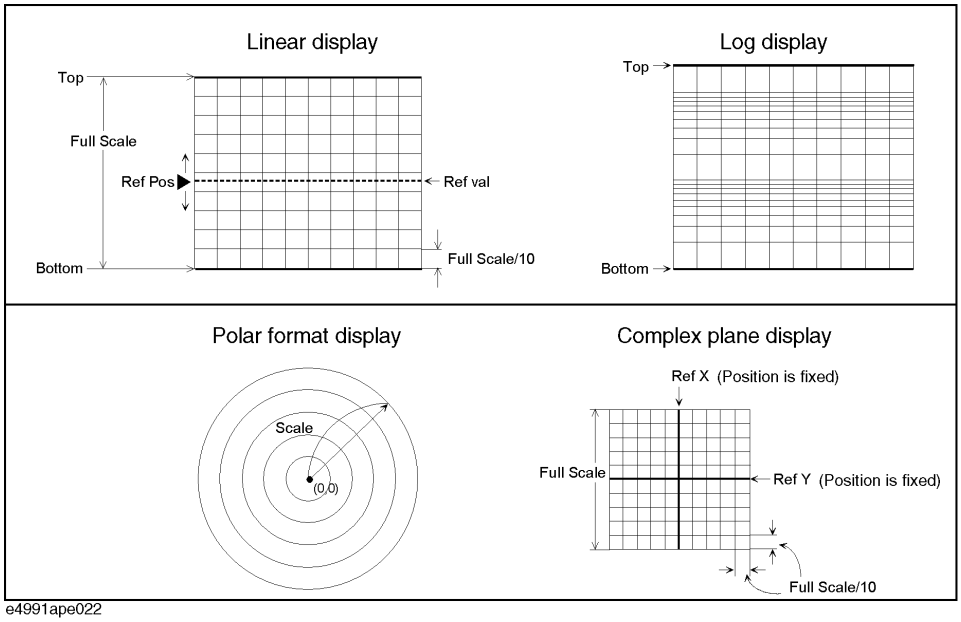
Use the following GPIB commands to set the X-axis and Y- axis reference values and a full-scale value.

Display format	Parameter to be set	GPIB command
Complex plane format	X-axis reference value	**DISP:TRAC{4-5}:X:RLEV** on page 362
	Y-axis reference value	**DISP:TRAC{1-5}:Y:RLEV** on page 369
	Full-scale value	**DISP:TRAC{1-5}:Y:FULL** on page 367

Smith Chart and Admittance Chart

The scales of these formats are fixed and thus cannot be changed.

Figure 3-2 **Display Scale Parameters**



e4991ape022

Use the following GPIB commands to set the scale parameters shown in Figure 3-2.

Full Scale	**DISP:TRAC{1-5}:Y:FULL** on page 367
Full Scale/10*1	**DISP:TRAC{1-5}:Y:PDIV** on page 368
Top	**DISP:TRAC{1-3}:Y:TOP** on page 372
Bottom	**DISP:TRAC{1-3}:Y:BOTT** on page 365
Ref Pos	**DISP:TRAC{1-3}:Y:RPOS** on page 370
Ref Val	**DISP:TRAC{1-5}:Y:RLEV** on page 369
Ref X	**DISP:TRAC{4-5}:X:RLEV** on page 362
Ref Y	**DISP:TRAC{1-5}:Y:RLEV** on page 369

*1. With the display format set to Linear display or Complex plane, one-tenth of the full-scale value can be used instead. However, one-tenth of the full-scale does not always correspond to a grid width (Grid lines are not always displayed at an interval of one-tenth of the full-scale).

Example program for setting the measuring conditions

An example program for setting the measuring conditions is shown below. This program sets the E4991A as follows after resetting it. When the setting is complete, a completion message is displayed.

Setting item	Trace 1	Trace 2	Trace 4
Measurement mode	Impedance measurement		
Display trace	Scalar	Scalar	Complex
Measurement parameter	|Z|	θz	Γ
Display format	Log Y-axis	Linear Y-axis	Smith
Phase display unit	---	° (degrees)	---
Expanded phase display	---	On	---
Sweep parameter (sweep type)	Frequency sweep (log sweep)		
Start frequency	100 MHz		
Stop frequency	3 GHz		
Number of measurement points	201		
Measurement direction	Up		
Sweep averaging factor	16		
Point averaging factor	0 (off)		
Sweep time	Auto		
Delay time at the start of sweep	0 seconds		
Delay time at each measurement point	0 seconds (When the sweep time is auto, the delay time is 0 seconds)		
Oscillator level	1 mA		
dc bias output voltage level	15 V		
dc bias current limit maximum value	10 mA		
Full-scale value	---	500	---
Reference value	---	0	---
Reference position	---	50	---
Maximum scale	100	---	---
Minimum scale	0.1	---	---

Example program using HTBasic

The program shown in Example 3-1 is saved under the filename setup.htb on the sample programs disk. The details of this program are explained as follows.

Line 230	Sets the GPIB address of the E4991A.
Lines 250 - 290	Substitutes a variable for the trace number.
Lines 310 - 450	Substitutes variables for the on/off status of each trace display, measurement parameter, trace display format, and Y-axis display format. In addition, when the measurement parameter is a phase (Trace 2), substitutes variables for the expanded phase display and the phase display format display unit.
Lines 470 - 510	Substitutes variables for the sweep-related parameter values (sweep parameter/type, sweep range, number of measurement points, and sweep direction).
Lines 520 - 540	Substitutes variables for the average-related parameter values (sweep averaging and point averaging).
Lines 550 - 560	Substitutes variables for the auto/manual setting of the sweep time and sweep delay time.
Lines 570 - 580	Substitutes variables for the oscillator level-related parameters.
Lines 590 - 600	Substitutes variables for the dc bias-related parameter values.
Lines 620 - 670	Substitutes variables for the on/off status of the list display of the measurement screen and the object of the display trace (data trace/memory trace).
Lines 680 - 720	Substitutes variables for the display scale-related parameter values.
Line 740	Resets the E4991A.
Line 780	Sets the E4991A to impedance measurement mode.
Lines 800 - 940	Sets the measurement parameters for Traces 1, 2, and 4, the trace display format, and the Y-axis display format. In addition, for Trace 2, sets the expanded phase display as well as the display units of the phase display format.
Lines 960 - 970	Turns off Traces 3 and 5.
Line 1010	Sets the sweep parameter (type).
Lines 1030 - 1040	Sets the sweep range for the frequency sweep range.
Lines 1060 - 1120	Sets the measurement point, sweep direction, Sweep averaging function on/off status, averaging factor, point averaging function on/off status, auto/manual setting of the sweep time, and sweep delay time.
Lines 1060 - 1120	Selects the fixed mode for oscillator current mode and sets the oscillator current level. Next, sets the voltage level in the dc bias fixed mode and sets the maximum value of the dc bias current limit.
Lines 1230 - 1390	Sets the display scales of Traces 1, 2, and 4.
Line 1430	Turns on the dc bias output.
Line 1470	Displays a setting completion message.

Example 3-1 **Setting measuring conditions (HTBasic)**

```
10      INTEGER Trc1,Trc2,Trc3,Trc4,Trc5
20      INTEGER Nop,Sweep_avg_coun
30      REAL Start_freq,Stop_freq,Sweep_delay
40      REAL Sour_curr,Dc_bias_v,Dc_bias_i_lim
50      REAL Full_sacle1,Full_scale2,Full_scale4
60      REAL Ref_val1,Ref_val2,Ref_val4
70      REAL Ref_pos1,Ref_pos2,Ref_pos4
80      REAL Top_scale1,Top_scale2,Top_scale4
90      REAL Bottom_scale1,Bottom_scale2,Bottom_scale4
100     DIM Trac1$[3],Trac2$[3],Trac3$[3],Trac4$[3],Trac5$[3]
110     DIM M_para1$[4],M_para2$[4],M_para4$[4]
120     DIM Disp_form1$[10],Disp_form2$[10],Disp_form4$[10]
130     DIM Disp_y_spac1$[11],Disp_y_spac2$[11],Disp_y_spac4$[11]
140     DIM Phase_unit1$[3],Phase_unit2$[3],Phase_unit4$[3]
150     DIM Phase_exp1$[3],Phase_exp2$[3],Phase_exp4$[3]
160     DIM
Sweep_type$[11],Sweep_dir$[4],Sweep_avg$[3],Point_avg$[3]
170     DIM Sweep_t_auto$[3],Sour_curr_mode$[5]
180     DIM List_page1$[3],List_page2$[3],List_page4$[3]
190     DIM Disp_trac1$[4],Disp_trac2$[4],Disp_trac4$[4]
200     DIM Buff$[9]
210     !
220     CLEAR SCREEN
230     ASSIGN @Agte4991a TO 717
240     !
250     Trc1=1
260     Trc2=2
270     Trc3=3
280     Trc4=4
290     Trc5=5
300     !
310     Trac1$="ON"
320     Trac2$="ON"
330     Trac3$="OFF"
340     Trac4$="ON"
350     Trac5$="OFF"
360     M_para1$="Z"
370     M_para2$="ZPH"
380     M_para4$="RC"
390     Disp_form1$="RECT"
400     Disp_form2$="RECT"
410     Disp_form4$="SMIT"
420     Disp_y_spac1$="LOG"
430     Disp_y_spac2$="LIN"
440     Phase_unit2$="DEG"
450     Phase_exp2$="ON"
460     !
470     Sweep_type$="LOG"
480     Start_freq=1.00E+8
490     Stop_freq=3.E+9
500     Nop=201
510     Sweep_dir$="UP"
520     Sweep_avg_coun=16
530     Sweep_avg$="ON"
540     Point_avg$="OFF"
```

```
550     Sweep_t_auto$="ON"
560     Sweep_delay=0
570     Sour_curr_mode$="FIX"
580     Sour_curr=1.E-3
590     Dc_bias_v=15
600     Dc_bias_i_lim=1.0E-2
610     !
620     List_page1$="OFF"
630     List_page2$="OFF"
640     List_page4$="OFF"
650     Disp_trac1$="DATA"
660     Disp_trac2$="DATA"
670     Disp_trac4$="DATA"
680     Top_scale1=100
690     Bottom_scale1=.1
700     Full_scale2=500
710     Ref_val2=0
720     Ref_pos2=50
730     !
740     OUTPUT @Agte4991a;"SYST:PRES"
750     !
760     ! Measurement Mode & Parameter & Disp Format Setting
770     !
780     OUTPUT @Agte4991a;"MODE IMP"
790     !
800     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&" "&Trac1$
810     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":FORM "&M_para1$
820     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&":GRAT:FORM
"&Disp_form1$
830     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&":Y:SPAC
"&Disp_y_spac1$
840     !
850     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc2)&" "&Trac2$
860     OUTPUT @Agte4991a;"CALC"&VAL$(Trc2)&":FORM "&M_para2$
870     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc2)&":GRAT:FORM
"&Disp_form2$
880     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc2)&":Y:SPAC
"&Disp_y_spac2$
890     OUTPUT @Agte4991a;"CALC"&VAL$(Trc2)&":FORM:UNIT:ANGL
"&Phase_unit2$
900     OUTPUT @Agte4991a;"CALC"&VAL$(Trc2)&":FORM:PAR:EPH
"&Phase_exp2$
910     !
920     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc4)&" "&Trac4$
930     OUTPUT @Agte4991a;"CALC"&VAL$(Trc4)&":FORM "&M_para4$
940     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc4)&":GRAT:FORM
"&Disp_form4$
950     !
960     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc3)&" "&Trac3$
970     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc5)&" "&Trac5$
980     !
990     ! Sweep & Average Setting
1000    !
1010    OUTPUT @Agte4991a;"SWE:TYPE "&Sweep_type$
1020    !
1030    OUTPUT @Agte4991a;"FREQ:STAR "&VAL$(Start_freq)
1040    OUTPUT @Agte4991a;"FREQ:STOP "&VAL$(Stop_freq)
1050    !
```

Example program for setting the measuring conditions

```
1060   OUTPUT @Agte4991a;"SWE:POIN "&VAL$(Nop)
1070   OUTPUT @Agte4991a;"SWE:DIR "&Sweep_dir$
1080   OUTPUT @Agte4991a;"CALC:AVER:COUN "&VAL$(Sweep_avg_coun)
1090   OUTPUT @Agte4991a;"CALC:AVER "&Sweep_avg$
1100   OUTPUT @Agte4991a;"AVER "&Point_avg$
1110   OUTPUT @Agte4991a;"SWE:TIME:AUTO "&Sweep_t_auto$
1120   OUTPUT @Agte4991a;"SWE:DWEL1 "&VAL$(Sweep_delay)
1130   !
1140   ! Source Setting
1150   !
1160   OUTPUT @Agte4991a;"SOUR:CURR:MODE "&Sour_curr_mode$
1170   OUTPUT @Agte4991a;"SOUR:CURR "&VAL$(Sour_curr)
1180   OUTPUT @Agte4991a;"SOUR:VOLT:OFFS "&VAL$(Dc_bias_v)
1190   OUTPUT @Agte4991a;"SOUR:CURR:LIM:OFFS "&VAL$(Dc_bias_i_lim)
1200   !
1210   ! Trace1 Setting
1220   !
1230   OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&":TEXT
"&List_page1$
1240   OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MATH:FUNC
"&Disp_trac1$
1250   OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&":Y:TOP
"&VAL$(Top_scale1)
1260   OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&":Y:BOTT
"&VAL$(Bottom_scale1)
1270   !
1280   ! Trace2 Setting
1290   !
1300   OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc2)&":TEXT
"&List_page2$
1310   OUTPUT @Agte4991a;"CALC"&VAL$(Trc2)&":MATH:FUNC
"&Disp_trac2$
1320   OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc2)&":Y:FULL
"&VAL$(Full_scale2)
1330   OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc2)&":Y:RLEV
"&VAL$(Ref_val2)
1340   OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc2)&":Y:RPOS
"&VAL$(Ref_pos2)
1350   !
1360   ! Trace4 Setting
1370   !
1380   OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc4)&":TEXT
"&List_page4$
1390   OUTPUT @Agte4991a;"CALC"&VAL$(Trc4)&":MATH:FUNC
"&Disp_trac4$
1400   !
1410   ! DC Bias ON
1420   !
1430   OUTPUT @Agte4991a;"SOUR:VOLT:OFFS:STAT ON"
1440   !
1450   OUTPUT @Agte4991a;"*OPC?"
1460   ENTER @Agte4991a;Buff$
1470   PRINT "Measurement Condition Setup Complete"
1480   !
1490   END
```

Example program using macro (E4991A VBA)

The program shown in Example 3-2 is saved under the filename setup.bas on the sample programs disk. The details of this program are explained as follows.

Lines 260 - 300	Substitutes a variable for the trace number.
Lines 320 - 460	Substitutes variables for the on/off status of each trace display, measurement parameter, trace display format, and Y-axis display format. In addition, when the measurement parameter is a phase (Trace 2), substitutes variables for the expanded phase display and the phase display format display unit.
Lines 480 - 520	Substitutes variables for the sweep-related parameter values (sweep parameter/type, sweep range, number of measurement points, and sweep direction).
Lines 530 - 550	Substitutes variables for the average-related parameter values (sweep averaging and point averaging).
Lines 560 - 570	Substitutes variables for the auto/manual setting of the sweep time and sweep delay time.
Lines 580 - 590	Substitutes variables for the oscillator level-related parameters.
Lines 600 - 610	Substitutes variables for the dc bias-related parameter values.
Lines 630 - 680	Substitutes variables for the on/off status of the list display of the measurement screen and the object of the display trace (data trace/memory trace).
Lines 690 - 730	Substitutes variables for the display scale-related parameter values.
Line 750	Resets the E4991A.
Line 790	Sets the E4991A to the impedance measurement mode.
Lines 810 - 950	Sets the measurement parameters for Traces 1, 2, and 4, the trace display format, and the Y-axis display format. In addition, for Trace 2, sets the expanded phase display, as well as the display units of the phase display format.
Lines 970 - 980	Turns off the Traces 3 and 5.
Line 1020	Sets the sweep parameter (type).
Lines 1040 - 1050	Sets the sweep range for the frequency sweep range.
Lines 1070 - 1130	Sets the measurement point, sweep direction, Sweep averaging function on/off status, averaging factor, point averaging function on/off status, auto/manual setting of the sweep time, and sweep delay time.
Lines 1170 - 1200	Selects the fixed mode of oscillator current mode and sets the oscillator current level. Next, sets the voltage level in the dc bias fixed mode and sets the maximum value of the dc bias current limit.
Lines 1240 - 1410	Sets the display scales of Traces 1, 2, and 4.
Line 1450	Turns on the dc bias output.
Line 1510	Stops the execution of the macro.

Example 3-2 **Setting measuring conditions (macro)**

```
10      Sub Main()
20        Dim trc1 As Integer, trc2 As Integer, trc3 As Integer
30        Dim trc4 As Integer, trc5 As Integer
40        Dim nop As Integer, sweep_avg_coun As Integer
50       Dim start_freq As Double, stop_freq As Double, sweep_delay
As Double
60        Dim sour_curr As Double, dc_bias_v As Double,
dc_bias_i_lim As Double
70        Dim full_scale1 As Double, full_scale2 As Double,
full_scale4 As Double
80        Dim ref_val1 As Double, ref_val2 As Double, ref_val4 As
Double
90        Dim ref_pos1 As Double, ref_pos2 As Double, ref_pos4 As
Double
100      Dim top_scale1 As Double, top_scale2 As Double, top_scale4
As Double
110       Dim bottom_scale1 As Double, bottom_scale2 As Double,
bottom_scale4 As Double
120       Dim trac1 As String, trac2 As String, trac3 As String
130       Dim trac4 As String, trac5 As String
140       Dim m_para1 As String, m_para2 As String, m_para4 As
String
150      Dim disp_form1 As String, disp_form2 As String, disp_form4
As String
160       Dim disp_y_spac1 As String, disp_y_spac2 As String,
disp_y_spac4 As String
170       Dim phase_unit1 As String, phase_unit2 As String,
phase_unit4 As String
180      Dim phase_exp1 As String, phase_exp2 As String, phase_exp4
As String
190       Dim sweep_type As String, sweep_dir As String
200       Dim sweep_avg As String, point_avg As String
210       Dim sweep_t_auto As String, sour_curr_mode As String
220      Dim list_page1 As String, list_page2 As String, list_page4
As String
230      Dim disp_trac1 As String, disp_trac2 As String, disp_trac4
As String
240       Dim buff As String
250
260       trc1 = 1
270       trc2 = 2
280       trc3 = 3
290       trc4 = 4
300       trc5 = 5
310
320       trac1 = "ON"
330       trac2 = "ON"
340       trac3 = "OFF"
350       trac4 = "ON"
360       trac5 = "OFF"
370       m_para1 = "Z"
380       m_para2 = "ZPH"
390       m_para4 = "RC"
400       disp_form1 = "RECT"
410       disp_form2 = "RECT"
```

```
420       disp_form4 = "SMIT"
430       disp_y_spac1 = "LOG"
440       disp_y_spac2 = "LIN"
450       phase_unit2 = "DEG"
460       phase_exp2 = "ON"
470
480       sweep_type = "LOG"
490       start_freq = 100000000#
500       stop_freq = 3000000000#
510       nop = 201
520       sweep_dir = "UP"
530       sweep_avg_coun = 16
540       sweep_avg = "ON"
550       point_avg = "ON"
560       sweep_t_auto = "ON"
570       sweep_delay = 0
580       sour_curr_mode = "FIX"
590       sour_curr = 0.001
600       dc_bias_v = 15
610       dc_bias_i_lim = 0.01
620
630       list_page1 = "OFF"
640       list_page2 = "OFF"
650       list_page4 = "OFF"
660       disp_trac1 = "DATA"
670       disp_trac2 = "DATA"
680       disp_trac4 = "DATA"
690       top_scale1 = 100
700       bottom_scale1 = 0.1
710       full_scale2 = 500
720       ref_val2 = 0
730       ref = pos2 = 50
740
750       SCPI.Output "SYST:PRES"
760
770       ' Measurement Mode & Parameter & Disp Format Setting
780
790       SCPI.Output "MODE IMP"
800
810       SCPI.Output "DISP:TRAC" & CStr(trc1) & " " & trac1
820       SCPI.Output "CALC" & CStr(trc1) & ":FORM " & m_para1
830       SCPI.Output "DISP:TRAC" & CStr(trc1) & ":GRAT:FORM " &
disp_form1
840       SCPI.Output "DISP:TRAC" & CStr(trc1) & ":Y:SPAC " &
disp_y_spac1
850
860       SCPI.Output "DISP:TRAC" & CStr(trc2) & " " & trac2
870       SCPI.Output "CALC" & CStr(trc2) & ":FORM " & m_para2
880       SCPI.Output "DISP:TRAC" & CStr(trc2) & ":GRAT:FORM " &
disp_form2
890       SCPI.Output "DISP:TRAC" & CStr(trc2) & ":Y:SPAC " &
disp_y_spac2
900       SCPI.Output "CALC" & CStr(trc2) & ":FORM:UNIT:ANGL " &
phase_unit2
910       SCPI.Output "CALC" & CStr(trc2) & ":FORM:PAR:EPH " &
phase_exp2
920
930       SCPI.Output "DISP:TRAC" & CStr(trc4) & " " & trac4
```

Example program for setting the measuring conditions

```
940       SCPI.Output "CALC" & CStr(trc4) & ":FORM " & m_para4
950       SCPI.Output "DISP:TRAC" & CStr(trc4) & ":GRAT:FORM " &
disp_form4
960
970       SCPI.Output "DISP:TRAC" & CStr(trc3) & " " & trac3
980       SCPI.Output "DISP:TRAC" & CStr(trc5) & " " & trac5
990
1000      ' Sweep & Average Setting
1010
1020      SCPI.Output "SWE:TYPE " & sweep_type
1030
1040      SCPI.Output "FREQ:STAR " & CStr(start_freq)
1050      SCPI.Output "FREQ:STOP " & CStr(stop_freq)
1060
1070      SCPI.Output "SWE:POIN " & CStr(nop)
1080      SCPI.Output "SWE:DIR " & sweep_dir
1090      SCPI.Output "CALC:AVER:COUN " & CStr(sweep_avg_coun)
1100      SCPI.Output "CALC:AVER " & sweep_avg
1110      SCPI.Output "AVER " & point_avg
1120      SCPI.Output "SWE:TIME:AUTO " & sweep_t_auto
1130      SCPI.Output "SWE:DWEL1 " & CStr(sweep_delay)
1140
1150      ' Source Setting
1160
1170      SCPI.Output "SOUR:CURR:MODE " & sour_curr_mode
1180      SCPI.Output "SOUR:CURR " & CStr(sour_curr)
1190      SCPI.Output "SOUR:VOLT:OFFS " & CStr(dc_bias_v)
1200      SCPI.Output "SOUR:CURR:LIM:OFFS " & CStr(dc_bias_i_lim)
1210      '
1220      ' Trace1 Setting
1230      '
1240      SCPI.Output "DISP:TRAC" & CStr(trc1) & ":TEXT " &
list_page1
1250
1260      SCPI.Output "CALC" & CStr(trc1) & ":MATH:FUNC " &
disp_trac1
1270      SCPI.Output "DISP:TRAC" & CStr(trc1) & ":Y:TOP " &
CStr(top_scale1)
1280      SCPI.Output "DISP:TRAC" & CStr(trc1) & ":Y:BOTT " &
CStr(bottom_scale1)
1290
1300      ' Trace2 Setting
1310
1320      SCPI.Output "DISP:TRAC" & CStr(trc2) & ":TEXT " &
list_page2
1330      SCPI.Output "CALC" & CStr(trc2) & ":MATH:FUNC " &
disp_trac2
1340      SCPI.Output "DISP:TRAC" & CStr(trc2) & ":Y:FULL " &
CStr(full_scale2)
1350      SCPI.Output "DISP:TRAC" & CStr(trc2) & ":Y:RLEV " &
CStr(ref_val2)
1360      SCPI.Output "DISP:TRAC" & CStr(trc2) & ":Y:RPOS " &
CStr(ref_pos2)
1370
1380      ' Trace4 Setting
1390
1400      SCPI.Output "DISP:TRAC" & CStr(trc4) & ":TEXT " &
list_page4
```

```
1410      SCPI.Output "CALC" & CStr(trc4) & ":MATH:FUNC " &
disp_trac4
1420
1430      ' DC Bias ON
1440
1450      SCPI.Output "SOUR:VOLT:OFFS:STAT ON"
1460
1470      buff = SCPI.Query("*OPC?")
1480
1490      MsgBox ("Measurement Condition Setup Complete")
1500
1510      End
1520
1530    End Sub
```

Combination of Several Sweep Conditions (Segment Sweep)

The Agilent E4991A allows you to set combinations of up to 16 segments, each with its own sweep conditions, to perform segment sweep. A segment sweep table must be created before segment sweep can be performed.

Create/Edit Segment Sweep Table

The segment sweep table can be created or edited in two ways: specifying each segment parameter individually or specifying parameters collectively.

Display Segment Sweep Table

Use the following GPIB command to display the sweep conditions on the segment sweep table.

- **DISP:TEXT{1-3}:SET** on page 356

Create Segments and Read Total Number of Segments

To create a segment, use the following GPIB command to create the specified number of segments in the segment sweep table to make them available for editing. This command clears the existing segments and creates new segments. When this command is used in the query format, the total number of segments contained in the table is read.

- **SEGM:COUN** on page 397

Delete All Segments

Use the following GPIB command to delete all of the segments in the segment sweep table.

- **SEGM:DEL:ALL** on page 406

Select Oscillator Level Unit

Use the one of the following GPIB commands to select the unit (current/voltage/power) in which the oscillator level is set when the segment sweep table is created.

Oscillator level	GPIB command
Set in current	**SEGM:CURR:STAT** on page 402
Set in voltage	**SEGM:VOLT:STAT** on page 418
Set in power (dBm)	**SEGM:POW:STAT** on page 412

Select DC Bias Output Mode (DC Bias Function)

When the dc bias function is used, use one of the following GPIB commands to select whether the dc bias output level is set to the fixed voltage or fixed current source mode when the segment sweep table is created.

Output mode	GPIB command
Fixed current source mode	**SEGM:CURR:OFFS:STAT** on page 399
Fixed voltage source mode	**SEGM:VOLT:OFFS:STAT** on page 417

Set Each Segment Parameter Individually

Use the following GPIB command to set each parameter in the segment sweep table.

Table 3-4 Set of Parameters in Segment Sweep Table

Parameter		GPIB command
Frequency sweep range	Start value	**SEGM{1-16}:FREQ:STAR** on page 409
	Stop value	**SEGM{1-16}:FREQ:STOP** on page 410
	Center value	**SEGM{1-16}:FREQ:CENT** on page 407
	Span value	**SEGM{1-16}:FREQ:SPAN** on page 408
Number of measurement points*1		**SEGM{1-16}:SWE:POIN** on page 413
Point averaging factor		**SEGM{1-16}:AVER:COUN** on page 396
Oscillator level	Current value	**SEGM{1-16}:CURR** on page 398
	Voltage value	**SEGM{1-16}:VOLT** on page 414
	Power (dBm) value	**SEGM{1-16}:POW** on page 411
dc bias (Fixed voltage source)	Output voltage level	**SEGM{1-16}:VOLT:OFFS** on page 416
	Current limit maximum value	**SEGM{1-16}:CURR:LIM** on page 400
dc bias (Fixed current source)	Output current level	**SEGM{1-16}:CURR:OFFS** on page 401
	Voltage limit maximum value	**SEGM{1-16}:VOLT:LIM** on page 415

*1. The total number of measurement points for each segment cannot exceed 801. The **SWE:POIN** command can be used to read the total number of measurement points for each segment.

Set Segment Parameters Collectively

Use the following GPIB command to collectively set all of the parameters required to create the segment sweep table for each segment.

- **SEGM{1-16}:DATA** on page 403

The following GPIB command can be used to apply the same parameter values to all of the segments on the segment sweep table.

- **SEGM:DATA:ALL** on page 405

Turn On/Off DC Bias Output (DC Bias Function)

If dc bias is applied to the DUT during segment sweep, use the following GPIB command to turn on or off the dc bias output. When the output is switched from off to on, sweep is automatically set to the hold mode.

Use the following GPIB command to turn on or off the dc bias output in the fixed voltage source mode.

- **SOUR:VOLT:OFFS:STAT** on page 484

Use the following GPIB command to turn on or off the dc bias output in the fixed current source mode.

- **SOUR:CURR:OFFS:STAT** on page 465

Example program for setting the segment sweep conditions

An example program for setting the segment sweep conditions is described below. This program sets the segment sweep conditions as follows after resetting the E4991A. When the setting is complete, a completion message is displayed.

Segment sweep table setting item	Segment 1	Segment 2	Segment 3
Start frequency	1 MHz	100 MHz	1 GHz
Stop frequency	100 MHz	1 GHz	3 GHz
Number of measurement points	101	101	51
Oscillator output level	100 mV	100 mV	100 mV
dc bias output voltage level	10 V	10 V	10 V
dc bias current limit maximum value	10 mA	10 mA	10 mA
Number of point averaging	32	4	4
Sweep type	Segment sweep		
Delay time at each segment	0.1 sec		
X-axis span display format	Each segment		

Example program using HTBasic

The program shown in Example 3-3 is saved under the filename segm_set.htb on the sample programs disk. The details of this program are explained as follows.

Line 60 — Sets the GPIB address of the E4991A.

Lines 80 - 100 — Substitutes a variable for the total number of segments to be created. In addition, substitutes variables for the oscillator level and the setting units of the dc bias. However, when the dc bias function is not installed in the E4991A, enters “OFF” for the variable Dcbias_units$.

Line 140 — Resets the E4991A.

Lines 150 - 180 — Creates a segment in the segment sweep table and displays the table. In addition, sets the setting units of the oscillator level.

Line 200 — Branches the program for either the condition in which the dc bias function is installed or that in which it is not installed in the E4991A.

Lines 250 - 270 — Declares the parameters (start/stop frequency, number of measurement points, point averaging factor, oscillator output level, dc bias output voltage level, and dc bias current limit maximum value) that are necessary for setting the segment sweep table.

Line 290 — Sets the dc bias setting units for creating the segment sweep table.

Lines 300 - 340 — When the dc bias function is installed, reads the setting parameters necessary for creating the segment sweep table while looping for the total number of segments in the section and then provides the setting parameters to the sub-program.

Lines 400 - 480 — When the dc bias function is not installed, calls the sub-program to create the segment sweep table in this section.

Lines 520 - 540 Reads out the total number of segments created and indicates that the creation of the segment sweep table is complete.

Line 600 -760 When the dc bias function is installed, this sub program sets the start/stop frequency, number of measurement points, point averaging factor, and the oscillator output level. Sets the necessary setting parameters for each dc bias mode (fixed voltage source/fixed current source).

Lines 800 - 880 When the dc bias function is not installed, this sub-program sets the start/stop frequency, number of measurement points, point averaging factor, and oscillator output level for non-dc bias setting parameters.

Example 3-3 Setting segment sweep conditions (HTBasic)

```
10      INTEGER No_of_segment,Nop,Point_avg,Segm_no
20      REAL Start_f,Stop_f,Osc,Dcbias,Dcbias_lim
30      DIM Osc_unit$[7],Dcbias_unit$[6]
40      !
50      CLEAR SCREEN
60      ASSIGN @Agte4991a TO 717
70      !
80      No_of_segment=3
90      Osc_unit$="VOLT"                  ! CURR/VOLT/POW
100     Dcbias_unit$="VOLT"               ! CURR/VOLT/OFF
110     !
120     ! Initial Setting
130     !
140     OUTPUT @Agte4991a;"SYST:PRES"
150     OUTPUT @Agte4991a;"SEGM:COUN "&VAL$(No_of_segment)
160     OUTPUT @Agte4991a;"DISP:TEXT:STAT ON"
170     OUTPUT @Agte4991a;"DISP:TEXT1:SET"
180     OUTPUT @Agte4991a;"SEGM:"&Osc_unit$&":STAT ON"
190     !
200     IF Dcbias_unit$="CURR" OR Dcbias_unit$="VOLT" THEN
210     !
220     ! Entry Segment Data with DC Bias
230     !
240 Data_w_bias:!
250         DATA   1E6,  100E6,  101,  32,   0.1,   10,   0.01
260         DATA 100E6,    1E9,  101,   4,   0.1,   10,   0.01
270         DATA   1E9,    3E9,   51,   4,   0.1,   10,   0.01
280         !
290         OUTPUT @Agte4991a;"SEGM:"&Dcbias_unit$&":OFFS:STAT ON"
300         RESTORE Data_w_bias
310         FOR Segm_no=1 TO No_of_segment
320             READ
Start_f,Stop_f,Nop,Point_avg,Osc,Dcbias,Dcbias_lim
330             CALL
Segm_tbl_bias(@Agte4991a,Segm_no,Start_f,Stop_f,Nop,Point_avg,Osc_u
nit$,Osc,Dcbias_unit$,Dcbias,Dcbias_lim)
340         NEXT Segm_no
350     ELSE
360     !
370     ! Entry Segment Data w/o DC Bias
380     !
390 Data_wo_bias:!
400         DATA   1E6,  100E6,  101,  32,   0.1
```

Example program for setting the segment sweep conditions

```
410         DATA 100E6,    1E9,  101,   4,   0.1
420         DATA   1E9,    3E9,   51,   4,   0.1
430         !
440         RESTORE Data_wo_bias
450         FOR Segm_no=1 TO No_of_segment
460             READ Start_f,Stop_f,Nop,Point_avg,Osc
470             CALL
Segm_tbl(@Agte4991a,Segm_no,Start_f,Stop_f,Nop,Point_avg,Osc_unit$,
Osc)
480         NEXT Segm_no
490     END IF
500     !
510 Finish_entry:!
520     OUTPUT @Agte4991a;"SEGM:COUN?"
530     ENTER @Agte4991a;Seg_count
540     PRINT "Preparation of Segment Table finished. (No. of
Segmnet: "&VAL$(Seg_count)&")"
550     !
560     END
570     !
580     ! Segment Table Setting with DC Bias
590     !
600     SUB Segm_tbl_bias(@Agte4991a,INTEGER Seg_no,REAL
Start_f,Stop_f,INTEGER Nop,Point_avg,Osc_unit$,REAL
Osc,Dcbias_unit$,REAL Dcbias,Dcbias_lim)
610         !
620         OUTPUT @Agte4991a;"SEGM"&VAL$(Seg_no)&":FREQ:STAR
"&VAL$(Start_f)
630         OUTPUT @Agte4991a;"SEGM"&VAL$(Seg_no)&":FREQ:STOP
"&VAL$(Stop_f)
640         OUTPUT @Agte4991a;"SEGM"&VAL$(Seg_no)&":SWE:POIN
"&VAL$(Nop)
650         OUTPUT @Agte4991a;"SEGM"&VAL$(Seg_no)&":AVER:COUN
"&VAL$(Point_avg)
660         OUTPUT @Agte4991a;"SEGM"&VAL$(Seg_no)&":"&Osc_unit$&"
"&VAL$(Osc)
670         SELECT Dcbias_unit$
680         CASE "VOLT"
690             OUTPUT @Agte4991a;"SEGM"&VAL$(Seg_no)&":VOLT:OFFS
"&VAL$(Dcbias)
700             OUTPUT @Agte4991a;"SEGM"&VAL$(Seg_no)&":CURR:LIM
"&VAL$(Dcbias_lim)
710         CASE "CURR"
720             OUTPUT @Agte4991a;"SEGM"&VAL$(Seg_no)&":CURR:OFFS
"&VAL$(Dcbias)
730             OUTPUT @Agte4991a;"SEGM"&VAL$(Seg_no)&":VOLT:LIM
"&VAL$(Dcbias_lim)
740         END SELECT
750         !
760     SUBEND
770     !
780     ! Segment Table Setting w/o DC Bias
790     !
800     SUB Segm_tbl(@Agte4991a,INTEGER Seg_no,REAL
Start_f,Stop_f,INTEGER Nop,Point_avg,Osc_unit$,REAL Osc)
810         !
820         OUTPUT @Agte4991a;"SEGM"&VAL$(Seg_no)&":FREQ:STAR
"&VAL$(Start_f)
```

```
830         OUTPUT @Agte4991a;"SEGM"&VAL$(Seg_no)&":FREQ:STOP
"&VAL$(Stop_f)
840         OUTPUT @Agte4991a;"SEGM"&VAL$(Seg_no)&":SWE:POIN
"&VAL$(Nop)
850         OUTPUT @Agte4991a;"SEGM"&VAL$(Seg_no)&":AVER:COUN
"&VAL$(Point_avg)
860         OUTPUT @Agte4991a;"SEGM"&VAL$(Seg_no)&":"&Osc_unit$&"
"&VAL$(Osc)
870         !
880     SUBEND
```

Example program using macro (E4991A VBA)

The program shown in Example 3-4 is saved under the filename segm_set.bas on the sample programs disk. The details of this program are explained as follows.

Lines 90 - 110	Substitutes a variable for the total number of segments to be created. In addition, substitutes variables for the oscillator level and the setting units of the dc bias. However, when the dc bias function is not installed in the E4991A, enters “OFF” for the variable Dcbias_units$.
Lines 130 - 330	Substitutes a variable for the parameters (start/stop frequency, number of measurement points, point averaging factor, oscillator output level, dc bias output voltage level, and dc bias current limit maximum value) that are necessary for setting the segment sweep table.
Line 370	Resets the E4991A.
Lines 380 - 400	Creates a segment in the segment sweep table and displays the segment table. In addition, sets the setting units of the oscillator level.
Line 420	Branches the program for either the condition in which the dc bias function is installed or that in which it is not installed in the E4991A.
Line 430	Sets the dc bias setting units for creating the segment sweep table.
Lines 440 - 460	When the dc bias function is installed, reads the setting parameters necessary for creating the segment sweep table while looping for the total number of the segments in the section and then provides the setting parameters to the sub-program.
Lines 480 - 480	When the dc bias function is not installed, reads the setting parameters necessary for creating the segment sweep table while looping for the total number of the segments in section and then provides the setting parameters to the sub-program.
Lines 530 - 550	Reads out the total number of segments created and displays a message reading “Preparation of Segment Table Finished.”
Line 570	Stops the execution of the macro.
Line 610 -770	When the dc bias function is installed, this sub-program (segm_tbl_bias) sets the start/stop frequency, number of measurement points, point averaging factor, and the oscillator output level. Sets the necessary setting parameters for each dc bias mode (fixed voltage source/fixed current source).
Lines 790 - 870	When the dc bias function is not installed, this sub-program (segm_tbl) sets the start/stop frequency, number of measurement points, point averaging factor, and oscillator output level except for dc bias setting parameters.

Example 3-4 **Setting segment sweep conditions (macro)**

```
10      Sub Main()
20        Dim no_of_segment As Integer, segm_no As Integer
30        Dim nop(3) As Integer, point_avg(3) As Integer
40        Dim start_f(3) As Double, stop_f(3) As Double
50        Dim osc(3) As Double, dcbias(3) As Double, dcbias_lim(3)
As Double
60        Dim segm_count As Integer
```

```
70        Dim osc_unit As String, dcbias_unit As String
80
90        no_of_segment = 3
100       osc_unit = "VOLT"
110       dcbias_unit = "CURR"
120
130       start_f(1) = 1000000#
140       stop_f(1) = 100000000#
150       nop(1) = 101
160       point_avg(1) = 32
170       osc(1) = 0.1
180       dcbias(1) = 10
190       dcbias_lim(1) = 0.01
200       start_f(2) = 100000000#
210       stop_f(2) = 1000000000#
220       nop(2) = 101
230       point_avg(2) = 4
240       osc(2) = 0.1
250       dcbias(2) = 10
260       dcbias_lim(2) = 0.01
270       start_f(3) = 1000000000#
280       stop_f(3) = 3000000000#
290       nop(3) = 51
300       point_avg(3) = 4
310       osc(3) = 0.1
320       dcbias(3) = 10
330       dcbias_lim(3) = 0.01
340
350       ' Initial Setting
360
370       SCPI.Output "SYST:PRES"
380       SCPI.Output "SEGM:COUN " & CStr(no_of_segment)
390       SCPI.Output "DISP:TEXT:STAT ON"
400       SCPI.Output "SEGM:" & osc_unit & ":STAT ON"
410
420       If dcbias_unit = "VOLT" Or dcbias_unit = "CURR" Then
430         SCPI.Output "SEGM:" & dcbias_unit & ":OFFS:STAT ON"
440         For segm_no = 1 To no_of_segment
450           Call segm_tbl_bias(segm_no, start_f(segm_no),
stop_f(segm_no), nop(segm_no), point_avg(segm_no), osc_unit,
osc(segm_no), dcbias_unit, dcbias(segm_no), dcbias_lim(segm_no))
460         Next segm_no
470       ElseIf dcbias_unit = "OFF" Then
480         For segm_no = 1 To no_of_segment
490           Call segm_tbl(segm_no, start_f(segm_no),
stop_f(segm_no), nop(segm_no), point_avg(segm_no), osc_unit,
osc(segm_no))
500         Next segm_no
510       End If
520
530       segm_coun = SCPI.Query("SEGM:COUN?")
540       SCPI.Output "DISP:TEXT1:SET"
550       MsgBox ("Preparation of Segment Table Finished. (No. of
Segment: " & CStr(segm_coun)) & ")"
560
570       End
580
590     End Sub
```

Example program for setting the segment sweep conditions

```
600
610     Sub segm_tbl_bias(segm_no As Integer, start_f, stop_f As
Double, nop, point_avg As Integer, osc_unit As String, osc As
Double, dcbias_unit As String, dcbias, dcbias_lim As Double)
620
630       SCPI.Output "SEGM" & CStr(segm_no) & ":FREQ:STAR " &
CStr(start_f)
640       SCPI.Output "SEGM" & CStr(segm_no) & ":FREQ:STOP " &
CStr(stop_f)
650       SCPI.Output "SEGM" & CStr(segm_no) & ":SWE:POIN " &
CStr(nop)
660       SCPI.Output "SEGM" & CStr(segm_no) & ":AVER:COUN " &
CStr(point_avg)
670       SCPI.Output "SEGM" & CStr(segm_no) & ":" & osc_unit & " "
& CStr(osc)
680       Select Case dcbias_unit
690       Case "VOLT"
700         SCPI.Output "SEGM" & CStr(segm_no) & ":VOLT:OFFS " &
CStr(dcbias)
710         SCPI.Output "SEGM" & CStr(segm_no) & ":CURR:LIM " &
CStr(dcbias_lim)
720       Case "CURR"
730         SCPI.Output "SEGM" & CStr(segm_no) & ":CURR:OFFS " &
CStr(dcbias)
740         SCPI.Output "SEGM" & CStr(segm_no) & ":VOLT:LIM " &
CStr(dcbias_lim)
750       End Select
760
770     End Sub
780
790     Sub segm_tbl(segm_no As Integer, start_f, stop_f As Double,
nop, point_avg As Integer, osc_unit As String, osc As Double)
800
810       SCPI.Output "SEGM" & CStr(segm_no) & ":FREQ:STAR " &
CStr(start_f)
820       SCPI.Output "SEGM" & CStr(segm_no) & ":FREQ:STOP " &
CStr(stop_f)
830       SCPI.Output "SEGM" & CStr(segm_no) & ":SWE:POIN " &
CStr(nop)
840       SCPI.Output "SEGM" & CStr(segm_no) & ":AVER:COUN " &
CStr(point_avg)
850       SCPI.Output "SEGM" & CStr(segm_no) & ":" & osc_unit & " "
& CStr(osc)
860
870     End Sub
```

4 Preparation for Accurate Measurement

This chapter explains how to perform calibration as well as electrical length and fixture compensation for the Agilent E4991A.

Calibration

To assure accurate measurements, calibration must be performed on the DUT port on the test head. In the Dielectric Material measurement mode, calibration should be performed on the surface of the test fixture that makes contact with the DUT. The following section explains how to perform calibration.

Define Calibration Kit

Selection

Use the following GPIB command to select whether the 7-mm calibration kit included with the E4991A or a user-defined calibration kit is used for calibration.

- **SENS:CORR1:CKIT** on page 420

How to Enter Standard Values for User-Defined Calibration Kit

When a user-defined calibration kit is used to perform calibration, use the following GPIB command to select whether the Open/Short/Load standard values are set to a single value or different values for each frequency.

- **SENS:CORR1:CKIT:LIST** on page 421

Standard Value for User-Defined Calibration Kit (Single Value)

Use the following GPIB commands to define the Open/Short/Load standard values as a single value common to each frequency.

Standard	Parameter	GPIB command
Open	Conductance value (G)	**SENS:CORR1:CKIT:STAN1:G** on page 423
	Capacitance value (C)	**SENS:CORR1:CKIT:STAN1:C** on page 422
Short	Resistance value (R)	**SENS:CORR1:CKIT:STAN2:R** on page 429
	Inductance value (L)	**SENS:CORR1:CKIT:STAN2:L** on page 426
Load	Resistance value (R)	**SENS:CORR1:CKIT:STAN3:R** on page 433
	Inductance value (L)	**SENS:CORR1:CKIT:STAN3:L** on page 430

Standard Value Array for User-Defined Calibration Kit (Frequency)

By defining the Open/Short/Load standard values of the calibration kit as an array for each frequency, errors due to frequency characteristics of the Open/Short/Load standard can be removed. Use the following GPIB commands to define standard values as an array for each frequency.

Standard	Parameter	GPIB command
Open	Conductance value (G)	**SENS:CORR1:CKIT:STAN1:LIST:G** on page 425
	Susceptance value (B)	**SENS:CORR1:CKIT:STAN1:LIST:B** on page 424
Short	Resistance value (R)	**SENS:CORR1:CKIT:STAN2:LIST:R** on page 427
	Reactance value (X)	**SENS:CORR1:CKIT:STAN2:LIST:X** on page 428
Load	Resistance value (R)	**SENS:CORR1:CKIT:STAN3:LIST:R** on page 431
	Reactance value (X)	**SENS:CORR1:CKIT:STAN3:LIST:X** on page 432

Define Load Standard Value Used for Measurement of Dielectric Material

Selection

When performing calibration in the dielectric material measurement mode, use the following GPIB command to select whether the Load standard included with the Agilent 16453A or a user-defined Load standard is used.

- **SENS:CORR1:CKIT** on page 420

User-Defined Load Standard Value

If the Load standard included with the Agilent 16453A is used, each parameter of the Load standard is set to the E4991A predefined value. When a user-defined Load standard is used to perform calibration, the following GPIB commands must be used to define the parameters for the Load standard.

Standard	Parameter	GPIB command
Load	Relative permittivity	**SENS:CORR1:CKIT:STAN7:PRE** on page 435
	Dielectric loss factor	**SENS:CORR1:CKIT:STAN7:PLF** on page 434
	Thickness	**SENS:CORR1:CKIT:STAN7:THIC** on page 436

Select Calibration Data Measurement Points

Select calibration data measurement points from the following table. Note that when fixed points are used to measure calibration data, calibration coefficients are calculated through interpolation.

Measurement points	Description
Fixed frequency / fixed power points calibration	Measures calibration data at the predefined fixed frequency points and over the entire oscillator level range.
Fixed frequency / user defined power points calibration	Measures calibration data at the predefined fixed frequency points and at user defined oscillator level.
User defined frequency / user defined power points calibration	Measures calibration data at user defined frequency points and at user defined oscillator level.

Use the following GPIB command to select calibration data measurement points.

- **SENS:CORR1:COLL:FPO** on page 438

NOTE

Calibration data measurement points are set in coordination with fixture compensation data measurement points. To select fixture compensation data measurement points, use the **SENS:CORR2:COLL:FPO** command.

Measure Calibration Data

Perform Measurement

Use the following GPIB command to measure Open/Short/Load and, if necessary, Low-loss capacitor calibration data used to calculate calibration coefficients.

- **SENS:CORR1:COLL** on page 437

NOTE If a trigger source is set to an external trigger, execution of the above command does not start calibration data measurement. After executing this command, prepare a trigger.

NOTE In the dielectric material measurement mode, an Open/Short/Load standard is used on the DUT-connect surface of the text fixture to measure calibration data. If the dielectric material measurement mode is selected, the test fixture is automatically set to Agilent 16543A, eliminating the need to select a test fixture in advance. In addition, fixture compensation is disabled in this mode.

Completion of calibration data measurement can be detected by monitoring when the status bit 0 of the Operation Status Event Register changes. Use one of the following GPIB commands to monitor the status bit.

- **STAT:OPER:PTR** on page 492
- **STAT:OPER:NTR** on page 491
- **STAT:OPER:ENAB** on page 490
- ***SRE** on page 283

Enable Calibration

After measuring calibration data, use the following GPIB command to calculate calibration coefficients. This GPIB command automatically enables calibration.

- **SENS:CORR1:COLL:SAVE** on page 439

NOTE Calculation of calibration coefficients requires all of the Open/Short/Load measurement data. If the above command is executed before data measurement is complete, an error occurs and the command is ignored.

The following GPIB command can be used to disable the calibration function. However, this command cannot be used to enable calibration.

- **SENS:CORR1** on page 419

NOTE When the calibration function is disabled, calibration data arrays and calibration coefficient arrays are cleared.

Calibration Data Array/Calibration Coefficient Array

The calibration data array contains Open/Short/Load/Low-loss capacitor measurement data in the complex format. This measurement data is used for calculating calibration coefficients. The calibration coefficient array contains calibration coefficients in the complex format. They are calculated by using the calibration data array.

The calibration data and coefficient arrays can be read. The calibration coefficient array, once read, can be written back again.

Read Calibration Data Array

For details on how to read the calibration data array, refer to “Read Calibration Data Array” on page 77.

Read and Write Calibration Coefficient Array

For details on how to read and write the calibration coefficient array, refer to “Read and Write Calibration Coefficient Array” on page 77.

Clear Calibration Data and Coefficient Arrays

The following GPIB command can be used to clear the calibration data and coefficient arrays and disable the calibration function.

- **SENS:CORR1** on page 419

Example program for execution of calibration

The example program described below is used to measure each standard of the calibration kit to make the calibration function effective. When a user-defined calibration kit is used, after defining standard values, the calibration function is enabled by measuring each standard for Open, Short, Load, and Low-loss capacitor. Moreover, when the calibration function is enabled, the internally calculated calibration coefficient is saved in the external controller.

Example program using HTBasic

The program shown in Example 4-1 is saved under the filename cal_meas.htb on the sample programs disk. The details of this program are explained as follows.

Line 100	Sets the GPIB address.
Lines 140 - 150	Substitutes a variable for the calibration kit type and the obtained calibration data point.
Lines 170 - 180	Sets the calibration kit type and selects the measurement point for calibration.
Line 200	When the user-defined calibration kit is selected, the program branches, and each standard for the calibration kit is defined.
Line 220	Selects a setting that defines each standard value at a common unique value at all frequencies without using the list-setting function in the calibration kit.
Lines 260 - 430	Defines the standard value for Open (G-C), Short (R-L), and Load (R-L) using the value prepared by the user. However, each standard is defined in the sub-program (Inp_data).
Lines 480 - 590	Measures calibration data for Open/Short/Load standards. Measurement of the calibration data, however, is performed in the sub-program (FNCal). If a GPIB error occurs during the calibration data measurement, a value of -1 is returned from the function sub-program, so the calibration is programmed to be halted at that point.
Lines 630 - 690	Chooses whether the Low-loss capacitor is measured. If yes, the measurement is executed.
Lines 730 - 770	Calculates the calibration coefficient and sets on the calibration function. After that, completion of the calibration is indicated.
Lines 810 - 850	Reads the number of points for a sweep, and using this value, resets the range of array variables used when the calibration coefficient is read.
Lines 870 - 990	Reads the six calibration coefficient arrays in ASCII transfer format.
Lines 1010 - 1080	Saves the calibration coefficient array read and then saves it in the external computer in binary format. Then, the completion of read and write operations of the calibration coefficient is displayed.
Lines 1180 - 1190	Prompts connection of the calibration measurement standard specified by the variable Standard$ and waits for the input of **[Y]** or **[y]** after the connection.
Line 1210	Clears the status byte register and operation status event register.

Lines 1220 - 1230 Sets the bit 0 of the operation status event register at 1 only when the operation status condition register bit 0 transits from 1 to 0 (negative transition).

Lines 1240 - 1250 Sets bit 0 of the operation status event register as effective and, upon completion of calibration, sets bit 7 of the status byte register as effective.

Lines 1260 - 1270 Sets the branch for the SRQ interruption and enables SRQ interruption.

Lines 1280 - 1370 Sends the command for calibration of the standard specified by the variable Standard$ and measures the calibration data.

Lines 1380 - 1390 Displays a message indicating measurement that is in progress and waits for the completion of the measurement.

Lines 1410 - 1570 Checks whether a GPIB error occurred in the E4991A during measurement. If no error occurred, displays a message indicating completion of measurement and returns a value of 0 from the function sub-program. However, if there was an error, an error message and a measurement halt message are displayed and a value of -1 is returned from the function sub-program.

Lines 1620 - 1630 Prompts input of the standard value of the user-defined calibration kit specified by the variable Mes$ and waits for the input.

Lines 1640 - 1670 Displays the input value and waits for input (made by using the **[Y/N]** keys) on whether it is accurate. If a key other than **[Y]** or **[y]** is pressed, it returns to the first line of the input.

Example 4-1 **Measurement of data for calibration (HTBasic)**

```
10      DIM Inp_char$[9],Buff$[9],File$[20]
20      DIM Cal_kit$[7],Cal_point$[9]
30      DIM Cal_a1(1:801,1:2),Cal_a2(1:801,1:2)
40      DIM Cal_b1(1:801,1:2),Cal_b2(1:801,1:2)
50      DIM Cal_c1(1:801,1:2),Cal_c2(1:801,1:2)
60      REAL
Open_g,Open_c,Short_r,Short_l,Load_r,Load_l,Load_q,Load_c,Load_d
70      INTEGER Inp_no,Result,Nop_cal,Data_size
80      !
90      CLEAR SCREEN
100     ASSIGN @Agte4991a TO 717
110     !
120     ! Initial Setting
130     !
140     Cal_kit$="DEF"                ! DEF/USER
150     Cal_point$="FIX"              ! FIX/FUS/USER
160     !
170     OUTPUT @Agte4991a;"SENS:CORR1:CKIT "&Cal_kit$
180     OUTPUT @Agte4991a;"SENS:CORR1:COLL:FPO "&Cal_point$
190     !
200     IF Cal_kit$="USER" THEN      ! Entry Value of User Define Std.
210       !
220       OUTPUT @Agte4991a;"SENS:CORR1:CKIT:LIST OFF"
230       !
240       ! Entry Open Std. Value (G-C)
250       !
```

```
260       CALL Inp_data("Open(G)",Open_g)
270       CALL Inp_data("Open(C)",Open_c)
280       OUTPUT @Agte4991a;"SENS:CORR1:CKIT:STAN1:G "&VAL$(Open_g)
290       OUTPUT @Agte4991a;"SENS:CORR1:CKIT:STAN1:C "&VAL$(Open_c)
300       !
310       ! Entry Short Std. Value (R-L)
320       !
330       CALL Inp_data("Short(R)",Short_r)
340       CALL Inp_data("Short(L)",Short_l)
350       OUTPUT @Agte4991a;"SENS:CORR1:CKIT:STAN2:R "&VAL$(Short_r)
360       OUTPUT @Agte4991a;"SENS:CORR1:CKIT:STAN2:L "&VAL$(Short_l)
370       !
380       ! Entry Load Std. Value (R-L)
390       !
400       CALL Inp_data("Load(R)",Load_r)
410       CALL Inp_data("Load(L)",Load_l)
420       OUTPUT @Agte4991a;"SENS:CORR1:CKIT:STAN3:R "&VAL$(Load_r)
430       OUTPUT @Agte4991a;"SENS:CORR1:CKIT:STAN3:L "&VAL$(Load_l)
440     END IF
450     !
460     ! Open Data Measurement
470     !
480     Result=FNCal(@Agte4991a,"Open")
490     IF Result<>0 THEN Prog_end
500     !
510     ! Short Data Measurement
520     !
530     Result=FNCal(@Agte4991a,"Short")
540     IF Result<>0 THEN Prog_end
550     !
560     ! Load Data Measurement
570     !
580     Result=FNCal(@Agte4991a,"Load")
590     IF Result<>0 THEN Prog_end
600     !
610     ! Low-Loss Capacitor Data Measurement
620     !
630     PRINT "Do you want to measure Low-Loss Capacitor?"
640     PRINT
650     INPUT "[Y/N]",Inp_char$
660     IF UPC$(Inp_char$)="Y" THEN
670       Result=FNCal(@Agte4991a,"Low-Loss C")
680       IF Result<>0 THEN Prog_end
690     END IF
700     !
710     ! Calibration Done
720     !
730     OUTPUT @Agte4991a;"SENS:CORR1:COLL:SAVE"
740     OUTPUT @Agte4991a;"*OPC?"
750     ENTER @Agte4991a;Buff$
760     PRINT "All Data Measurement Complete"
770     PRINT
780     !
790     ! Calibration Coefficient Array Reading & Saving
800     !
810     OUTPUT @Agte4991a;"SWE:POIN?"
820     ENTER @Agte4991a;Nop_cal
830     REDIM Cal_a1(1:Nop_cal,1:2),Cal_a2(1:Nop_cal,1:2)
```

```
840     REDIM Cal_b1(1:Nop_cal,1:2),Cal_b2(1:Nop_cal,1:2)
850     REDIM Cal_c1(1:Nop_cal,1:2),Cal_c2(1:Nop_cal,1:2)
860     !
870     OUTPUT @Agte4991a;"FORM:DATA ASC"
880     OUTPUT @Agte4991a;"DATA:CCO1?"
890     ENTER @Agte4991a;Cal_a1(*)
900     OUTPUT @Agte4991a;"DATA:CCO2?"
910     ENTER @Agte4991a;Cal_b1(*)
920     OUTPUT @Agte4991a;"DATA:CCO3?"
930     ENTER @Agte4991a;Cal_c1(*)
940     OUTPUT @Agte4991a;"DATA:CCO4?"
950     ENTER @Agte4991a;Cal_a2(*)
960     OUTPUT @Agte4991a;"DATA:CCO5?"
970     ENTER @Agte4991a;Cal_b2(*)
980     OUTPUT @Agte4991a;"DATA:CCO6?"
990     ENTER @Agte4991a;Cal_c2(*)
1000    !
1010    File$="CAL_COEF"
1020    Data_size=(Nop_cal*2*6)*8
1030    CREATE File$,Data_size
1040    ASSIGN @File TO File$;FORMAT OFF
1050    OUTPUT
@File;Cal_a1(*),Cal_b1(*),Cal_c1(*),Cal_a2(*),Cal_b2(*),Cal_c2(*)
1060    ASSIGN @File TO *
1070    !
1080    PRINT "Calibration Coefficient File Saving Complete"
1090    !
1100 Prog_end: END
1110    !
1120    ! Calibration Data Measurement Function
1130    !
1140    DEF FNCal(@Agte4991a,Standard$)
1150      DIM Inp_char$[9],Err_mes$[50]
1160      INTEGER Err_no
1170      !
1180      PRINT "Connect "&Standard$&" Standard to the DUT Port."
1190      INPUT "OK? [Y/N]",Inp_char$
1200      IF UPC$(Inp_char$)="Y" THEN
1210        OUTPUT @Agte4991a;"*CLS"
1220        OUTPUT @Agte4991a;"STAT:OPER:PTR 0"
1230        OUTPUT @Agte4991a;"STAT:OPER:NTR 1"
1240        OUTPUT @Agte4991a;"STAT:OPER:ENAB 1"
1250        OUTPUT @Agte4991a;"*SRE 128"
1260        ON INTR 7 GOTO Meas_end
1270        ENABLE INTR 7;2
1280        SELECT Standard$
1290        CASE "Open"
1300          OUTPUT @Agte4991a;"SENS:CORR1:COLL STAN1"
1310        CASE "Short"
1320          OUTPUT @Agte4991a;"SENS:CORR1:COLL STAN2"
1330        CASE "Load"
1340          OUTPUT @Agte4991a;"SENS:CORR1:COLL STAN3"
1350        CASE "Low-Loss C"
1360          OUTPUT @Agte4991a;"SENS:CORR1:COLL STAN4"
1370        END SELECT
1380        DISP "Now measuring..."
1390 Meas_wait: GOTO Meas_wait
1400 Meas_end: DISP
```

```
1410        OUTPUT @Agte4991a;"SYST:ERR?"
1420        ENTER @Agte4991a;Err_no,Err_mes$
1430        IF Err_no=0 THEN
1440          PRINT Standard$&" data measurement completion"
1450          PRINT
1460          RETURN 0
1470        ELSE
1480          PRINT "Error: "&Err_mes$
1490          PRINT "Program interruption"
1500          PRINT
1510          RETURN -1
1520        END IF
1530      ELSE
1540        PRINT "Program interruption"
1550        PRINT
1560        RETURN -1
1570      END IF
1580    FNEND
1590    !
1600    SUB Inp_data(Mes$,Inp_val)
1610      DIM Inp_char$[9]
1620      PRINT "Input "&Mes$
1630 Inp_start: INPUT "Value?",Inp_val
1640      PRINT Mes$&" Value: ";Inp_val
1650      PRINT
1660      INPUT "OK? [Y/N]",Inp_char$
1670      IF UPC$(Inp_char$)<>"Y" THEN Inp_start
1680    SUBEND
```

Example program using macro (E4991A VBA)

The program shown in Example 4-2 is saved under the filename cal_meas.bas on the sample programs disk. The details of this program are explained as follows.

Lines 130 - 140	Substitutes a variable for the calibration kit type and the obtained calibration data point.
Lines 160 - 170	Sets the calibration kit type and selects the measurement point for the calibration.
Line 190	When the user-defined calibration kit is selected (defines variable of cal_fix to USER), the program branches, and each standard for the calibration kit is defined.
Line 210	Selects a setting where each calibration standard value is defined without using the list setting function.
Lines 230 - 360	Defines the standard values for Open (G-C), Short (R-L), and Load (R-L) using the values prepared by the user. Defining each standard value is performed in the procedure (Inp_data).
Lines 400 - 470	Measures calibration data for Open/Short/Load standards. Measurement of the calibration data is performed in the function program (Cal). When measurement is aborted during the calibration, the function program returns a value of -1 and stops execution of the calibration.
Lines 490 - 530	Decides whether to measure the Low-loss capacitor. If yes, the measurement is executed.
Lines 550 - 570	Calculates the calibration coefficient and turns on the calibration function. After that, displays a message indicating completion of calibration.
Lines 590 - 710	Reads the six calibration coefficient arrays in ASCII transfer format.
Lines 730 - 740	Reads the number of measurements.
Lines 760 - 1000	Saves the calibration coefficient array to a floppy disk. After that, displays a message indicating the completion of read and write operations of the calibration coefficient.
Line 1020	Stops execution of the macro.
Line 1100	Prompts connection of the calibration measurement standard.
Lines 1150 - 1240	Measures the calibration data using the CalMeasure method after the standard is connected. The CalMeasure method returns the value of 1 when measurement is completed without problem but it returns the value of 0 when measurement is aborted during fixture compensation.
Lines 1260 - 1310	Displays a message when measurement is aborted, and the function program returns the value of -1. When measurement is completed without problem, it returns the value of 0.
Line 1330	When the standard is not connected, the function program returns the value of -1.
Lines 1380 - 1420	Inputs the specified data.

Example 4-2 Measurement of data for calibration (macro)

```
10      Sub Main()
20        Dim buff As String, file As String
30        Dim Cal_kit As String, Cal_point As String
40        Dim Cal_a1 As Variant, Cal_a2 As Variant
50        Dim Cal_b1 As Variant, Cal_b2 As Variant
60        Dim Cal_c1 As Variant, Cal_c2 As Variant
70        Dim Open_g As Double, Open_c As Double
80        Dim Short_r As Double, Short_l As Double
90        Dim Load_r As Double, Load_l As Double
100       Dim Result As Integer, Nop_cal As Integer, Inp_char As
Integer
110       Dim iFileNo As Integer, i As Integer
120
130       Cal_kit = "DEF"        'DEF/USER
140       Cal_point = "FIX"      'FIX/FUS/USER
150
160       SCPI.Output "SENS:CORR1:CKIT " & Cal_kit
170       SCPI.Output "SENS:CORR1:COLL:FPO " & Cal_point
180
190       If Cal_kit = "USER" Then
200
210         SCPI.Output "SENS:CORR1:CKIT:LIST OFF"
220
230         Call Inp_data("Open_G(S)", Open_g)
240         Call Inp_data("Open_C(F)", Open_c)
250         SCPI.Output "SENS:CORR1:CKIT:STAN1:G " & CStr(Open_g)
260         SCPI.Output "SENS:CORR1:CKIT:STAN1:C " & CStr(Open_c)
270
280         Call Inp_data("Short_R(ohm)", Short_r)
290         Call Inp_data("Short_L(H)", Short_l)
300         SCPI.Output "SENS:CORR1:CKIT:STAN2:R " & CStr(Short_r)
310         SCPI.Output "SENS:CORR1:CKIT:STAN2:L " & CStr(Short_l)
320
330         Call Inp_data("Load_R(ohm)", Load_r)
340         Call Inp_data("Load_L(H)", Load_l)
350         SCPI.Output "SENS:CORR1:CKIT:STAN3:R " & CStr(Load_r)
360         SCPI.Output "SENS:CORR1:CKIT:STAN3:L " & CStr(Load_l)
370
380       End If
390
400       Result = Cal("Open")
410       If Result <> 0 Then GoTo Prog_end
420
430       Result = Cal("Short")
440       If Result <> 0 Then GoTo Prog_end
450
460       Result = Cal("Load")
470       If Result <> 0 Then GoTo Prog_end
480
490       Inp_char = MsgBox("Do you want to measure a Low-Loss
Capacitor?", vbYesNo + vbQuestion, "Calibration")
500       If Inp_char = vbYes Then
510         Result = Cal("Low-loss C")
520         If Result <> 0 Then GoTo Prog_end
530       End If
540
550       SCPI.Output "SENS:CORR1:COLL:SAVE"
560       buff = SCPI.Query("*OPC?")
```

```
570       MsgBox "All cal-data measurement completion", vbOKOnly,
"Calibration"
580
590       SCPI.Output "FORM:DATA ASC"
600       SCPI.Output "DATA:CCO1?"
610       SCPI.Enter Cal_a1, "#"
620       SCPI.Output "DATA:CCO2?"
630       SCPI.Enter Cal_b1, "#"
640       SCPI.Output "DATA:CCO3?"
650       SCPI.Enter Cal_c1, "#"
660       SCPI.Output "DATA:CCO4?"
670       SCPI.Enter Cal_a2, "#"
680       SCPI.Output "DATA:CCO5?"
690       SCPI.Enter Cal_b2, "#"
700       SCPI.Output "DATA:CCO6?"
710       SCPI.Enter Cal_c2, "#"
720
730       SCPI.Output "SWE:POIN?"
740       SCPI.Enter Nop_cal
750
760       iFileNo = FreeFile
770       file = "a:\CAL_COEF"
780
790       Open file For Output As iFileNo
800       For i = 1 To Nop_cal * 2
810         Write #iFileNo, Val(Cal_a1(i - 1))
820       Next i
830       For i = 1 To Nop_cal * 2
840         Write #iFileNo, Val(Cal_b1(i - 1))
850       Next i
860       For i = 1 To Nop_cal * 2
870         Write #iFileNo, Val(Cal_c1(i - 1))
880       Next i
890       For i = 1 To Nop_cal * 2
900         Write #iFileNo, Val(Cal_a2(i - 1))
910       Next i
920       For i = 1 To Nop_cal * 2
930         Write #iFileNo, Val(Cal_b2(i - 1))
940       Next i
950       For i = 1 To Nop_cal * 2
960         Write #iFileNo, Val(Cal_c2(i - 1))
970       Next i
980       Close #iFileNo
990
1000      MsgBox "Saving Calibration Coefficient File Completion",
vbOKOnly, "Calibration"
1010
1020    Prog_end: End
1030
1040    End Sub
1050
1060    Function Cal(Standard As String) As Integer
1070      Dim Inp_char As Integer
1080      Dim bool As Long
1090
1100      Inp_char = MsgBox("Connect " & Standard & _
1110                        " standard to DUT port.", _
1120                         vbOKCancel, "Calibration")
```

```
1130
1140      If Inp_char = vbOK Then
1150        Select Case Standard
1160        Case "Open"
1170          bool = CalMeasure(CalOpen)
1180        Case "Short"
1190          bool = CalMeasure(CalShort)
1200        Case "Load"
1210          bool = CalMeasure(CalLoad)
1220        Case "Low-loss C"
1230          bool = CalMeasure(CalLowLossC)
1240        End Select
1250
1260        If bool = 0 Then
1270          MsgBox Standard & " Calibration aborted!", vbOKOnly,
"Calibration"
1280          Cal = -1
1290        Else
1300          Cal = 0
1310        End If
1320      Else
1330        Cal = -1
1340      End If
1350
1360    End Function
1370
1380    Sub Inp_data(Mes As String, Inp_val As Double)
1390
1400      Inp_val = Val(InputBox(Mes, "Input values"))
1410
1420    End Sub
```

Example program for calibration coefficient transfer

The example program shown below is for transferring a saved calibration coefficient array.

Example program using HTBasic

Example 4-3 shows an example program that enables the calibration function by transferring the calibration coefficient array saved in Example 4-1. This program is saved under the filename cal_inp.htb on the sample programs disk.

Line 70	Sets the GPIB address.
Line 90	Substitutes a variable for the file name for storing the calibration coefficient array.
Lines 110 - 180	Confirms whether the calibration function should be set to on. If yes, completes the program.
Lines 200 - 210	Reads the number of measurement points and substitutes a variable for it.
Lines 230 - 250	Re-allocates a value for the range of the calibration coefficient array using the number of measurement points.
Lines 300 - 320	Reads the calibration coefficient array stored in the external computer.
Lines 360 - 420	Transfers the calibration coefficient array from the external computer to the E4991A.

Example 4-3 **Transfer of calibration coefficient array (HTBasic)**

```
10     DIM File$[20]
20     DIM Cal_a1(1:801,1:2),Cal_a2(1:801,1:2)
30     DIM Cal_b1(1:801,1:2),Cal_b2(1:801,1:2)
40     DIM Cal_c1(1:801,1:2),Cal_c2(1:801,1:2)
50     INTEGER Nop,Corr
60     !
70     ASSIGN @Agte4991a TO 717
80     !
90     File$="CAL_COEF"
100    !
110    OUTPUT @Agte4991a;"SENS:CORR1?"
120    ENTER @Agte4991a;Corr
130    !
140    IF Corr=0 THEN
150      BEEP
160      PRINT " It is not available to transfer calibration
coefficient data to E4991A"
170      GOTO Prog_end
180    END IF
190    !
200    OUTPUT @Agte4991a;"SWE:POIN?"
210    ENTER @Agte4991a;Nop
220    !
230    REDIM Cal_a1(1:Nop,1:2),Cal_a2(1:Nop,1:2)
240    REDIM Cal_b1(1:Nop,1:2),Cal_b2(1:Nop,1:2)
250    REDIM Cal_c1(1:Nop,1:2),Cal_c2(1:Nop,1:2)
260    !
270    !
280    ! Load Data
```

```
290     !
300     ASSIGN @File TO File$
310     ENTER
@File;Cal_a1(*),Cal_b1(*),Cal_c1(*),Cal_a2(*),Cal_b2(*),Cal_c2(*)
320     ASSIGN @File TO *
330     !
340     ! Input Calibration Data
350     !
360     OUTPUT @Agte4991a;"FORM:DATA ASC"
370     OUTPUT @Agte4991a;"DATA:CCO1 ";Cal_a1(*)
380     OUTPUT @Agte4991a;"DATA:CCO2 ";Cal_b1(*)
390     OUTPUT @Agte4991a;"DATA:CCO3 ";Cal_c1(*)
400     OUTPUT @Agte4991a;"DATA:CCO4 ";Cal_a2(*)
410     OUTPUT @Agte4991a;"DATA:CCO5 ";Cal_b2(*)
420     OUTPUT @Agte4991a;"DATA:CCO6 ";Cal_c2(*)
430     !
440     PRINT "Data writting succeed!"
450     !
460 Prog_end:!
470     END
```

Example program using macro (E4991A VBA)

Example 4-4 shows an example program that enables the calibration function by transferring the calibration coefficient array saved in Example 4-2. This is saved under the filename cal_inp.bas on the sample programs disk.

Line 70	Sets the GPIB address.
Line 90	Substitutes a variable for the file name for storing the calibration coefficient array.
Lines 110 - 180	Confirms whether the calibration function should be set to on. If yes, completes the program.
Lines 200 - 210	Reads the number of measurement points and substitutes a variable for it.
Lines 230 - 250	Re-allocates a value to the range of the calibration coefficient array using the number of measurement points.
Lines 300 - 320	Reads the calibration coefficient array stored in the external computer.
Lines 360 - 420	Transfers the calibration coefficient array from the external computer to the E4991A.

Example 4-4 Transfer of calibration coefficient array (macro)

```
10      Sub Main()
20        Dim file As String
30        Dim Cal_a1() As Double, Cal_a2() As Double
40        Dim Cal_b1() As Double, Cal_b2() As Double
50        Dim Cal_c1() As Double, Cal_c2() As Double
60        Dim a1_data As String, a2_data As String
70        Dim b1_data As String, b2_data As String
80        Dim c1_data As String, c2_data As String
90        Dim Corr As Integer, Nop_cal As Integer
100       Dim iFileNo As Integer, i As Integer
110
120       SCPI.Output "SENS:CORR1?"
130       SCPI.Enter Corr
140       If Corr = 0 Then
150        MsgBox "It is unable to transfer calibration coefficient
data to E4991A", vbOKOnly + vbExclamation, "Transfer"
160         GoTo Prog_end
170       End If
180
190       SCPI.Output "SWE:POIN?"
200       SCPI.Enter Nop_cal
210
220       ReDim Cal_a1(1 To Nop_cal * 2), Cal_a2(1 To Nop_cal * 2)
230       ReDim Cal_b1(1 To Nop_cal * 2), Cal_b2(1 To Nop_cal * 2)
240       ReDim Cal_c1(1 To Nop_cal * 2), Cal_c2(1 To Nop_cal * 2)
250
260       ' -> Load Data
270
280       file = "a:\CAL_COEF"
290       iFileNo = FreeFile
300
310       Open file For Input As iFileNo
```

```
320       For i = 1 To Nop_cal * 2
330         Input #iFileNo, Cal_a1(i)
340       Next i
350       For i = 1 To Nop_cal * 2
360         Input #iFileNo, Cal_b1(i)
370       Next i
380       For i = 1 To Nop_cal * 2
390         Input #iFileNo, Cal_c1(i)
400       Next i
410       For i = 1 To Nop_cal * 2
420         Input #iFileNo, Cal_a2(i)
430       Next i
440       For i = 1 To Nop_cal * 2
450         Input #iFileNo, Cal_b2(i)
460       Next i
470       For i = 1 To Nop_cal * 2
480         Input #iFileNo, Cal_c2(i)
490       Next i
500
510       Close #iFileNo
520
530       data_a1 = Cal_a1(1)
540       data_b1 = Cal_b1(1)
550       data_c1 = Cal_c1(1)
560       data_a2 = Cal_a2(1)
570       data_b2 = Cal_b2(1)
580       data_c2 = Cal_c2(1)
590       For i = 2 To Nop_cal * 2
600         data_a1 = data_a1 & "," & Cal_a1(i)
610         data_b1 = data_b1 & "," & Cal_b1(i)
620         data_c1 = data_c1 & "," & Cal_c1(i)
630         data_a2 = data_a2 & "," & Cal_a2(i)
640         data_b2 = data_b2 & "," & Cal_b2(i)
650         data_c2 = data_c2 & "," & Cal_c2(i)
660       Next i
670
680       ' -> Input Calibration Data
690
700       SCPI.Output "FORM:DATA ASC"
710       SCPI.Output "DATA:CCO1 " & data_a1
720       SCPI.Output "DATA:CCO2 " & data_b1
730       SCPI.Output "DATA:CCO3 " & data_c1
740       SCPI.Output "DATA:CCO4 " & data_a2
750       SCPI.Output "DATA:CCO5 " & data_b2
760       SCPI.Output "DATA:CCO6 " & data_c2
770
780       MsgBox "Data Writing succeed!", vbOKOnly, "Transfer"
790
800       End
810
820     Prog_end: End Sub
```

Electrical Length Compensation

Test Fixture

Selection (Set Electrical Length)

Use the following GPIB command to select whether to use the Agilent test fixture or a custom test fixture.

- **SENS:CORR2:FIXT** on page 454

Table 4-1 lists the valid combination of test fixtures, the need for Option 002 (Material Measurement option), and measurement modes.

Table 4-1 Test Fixture List

Test Fixture	Material measurement option	Measurement mode
Agilent 16191A	Not needed	Impedance
Agilent 16192A		
Agilent 16193A		
Agilent 16194A		
Agilent 16196A		
Agilent 16196B		
Agilent 16196C		
Agilent 16197A		
Agilent 16453A	Needed	Dielectric material
Agilent 16454S		Magnetic material
Agilent 16454L		
Custom (User-created)	Not needed	Impedance

If the Agilent test fixture is used, the electrical length of the test fixture is set to the E4991A's predefined value, eliminating the need to enter the value. Use the following GPIB command to read the electrical length of the Agilent test fixture.

- **SENS:CORR2:FIXT:EDEL:MODE:DIST?** on page 455

Custom Test Fixture (Enter Electrical Length)

When you use a custom test fixture, use the following GPIB command to define the electrical length of the test fixture.

- **SENS:CORR2:FIXT:EDEL:USER:DIST** on page 456

Add Offset Delay Time (Port Extension Compensation)

In addition to the electrical length of the test fixture, if offset delay time occurs due to port extension, use the following GPIB command to remove the offset delay time.

- **SENS:CORR2:EDEL:TIME** on page 453

Fixture Compensation

The following section explains how to perform fixture compensation.

Define Fixture Compensation Kit

The values of the Open/Short standard included with the fixture compensation kit can be set to any values.

How to Enter Standard Values

Use the following GPIB command to select whether the values of the Open/Short standard included with the fixture compensation kit should be set to a single value or to a different value for each frequency.

- **SENS:CORR2:CKIT:LIST** on page 440

Standard Value (Single Value)

Use the following GPIB commands to define the Open/Short standard values as a single value common to each frequency.

Standard	Parameter	GPIB command
Open	Conductance value (G)	**SENS:CORR2:CKIT:STAN1:G** on page 442
	Capacitance value (C)	**SENS:CORR2:CKIT:STAN1:C** on page 441
Short	Resistance value (R)	**SENS:CORR2:CKIT:STAN2:R** on page 448
	Inductance value (L)	**SENS:CORR2:CKIT:STAN2:L** on page 445

Standard Value Array (For Each Frequency)

By defining Open/Short standard values of the fixture compensation kit as an array for each frequency, errors due to frequency characteristics of the standard can be removed. Use the following GPIB commands to define standard values as an array for each frequency.

Standard	Parameter	GPIB command
Open	Conductance value (G)	**SENS:CORR2:CKIT:STAN1:LIST:G** on page 444
	Susceptance value (B)	**SENS:CORR2:CKIT:STAN1:LIST:B** on page 443
Short	Resistance value (R)	**SENS:CORR2:CKIT:STAN2:LIST:R** on page 446
	Reactance value (X)	**SENS:CORR2:CKIT:STAN2:LIST:X** on page 447

Select Fixture Compensation Data Measurement Points

Select fixture compensation data measurement points from the following table. Note that when fixed points are used to measure fixture compensation data, fixture compensation coefficients are calculated through interpolation.

Measurement points	Description
Fixed frequency / fixed power points compensation	Measures fixture compensation data at the E4991A predefined fixed frequency points and over the entire oscillator range.
Fixed frequency / user defined power points compensation	Measures fixture compensation data at the E4991A predefined fixed frequency points and at user-defined oscillator level.
User-defined frequency / user defined power points compensation	Measures fixture compensation data at user defined frequency points and at user defined oscillator level.

Use the following GPIB command to select fixture compensation data measurement points.

- **SENS:CORR2:COLL:FPO** on page 450

NOTE

Calibration data measurement points are set in coordination with fixture compensation data measurement points. To select calibration data measurement points, use the **SENS:CORR1:COLL:FPO** command.

Measure Fixture Compensation Data

Perform Measurement

Use the following GPIB command to measure the Open/Short fixture compensation data used to calculate fixture compensation coefficients.

- **SENS:CORR2:COLL** on page 449

NOTE With a trigger source is set to an external trigger, the above command does not start measurement of fixture compensation data. After executing this command, prepare a trigger.

Completion of fixture compensation data measurement can be detected by monitoring when status bit 7 of the Operation Status Event Register changes. Use one of the following GPIB commands to monitor the status bit.

- **STAT:OPER:PTR** on page 492
- **STAT:OPER:NTR** on page 491
- **STAT:OPER:ENAB** on page 490
- ***SRE** on page 283

Enable Fixture Compensation Function

After measuring Open/Short fixture compensation data, use the following GPIB command to calculate fixture compensation coefficients. This GPIB command automatically enables the fixture compensation function.

- **SENS:CORR2:COLL:SAVE** on page 451

NOTE Calculation of fixture compensation coefficients requires Open and Short measurement data. If the above command is executed before all data measurement is complete, an error occurs and the command is ignored.

The following GPIB commands disable/enable Open and Short fixture compensation, respectively.

- **SENS:CORR2:COLL:OPEN** on page 451
- **SENS:CORR2:COLL:SHOR** on page 452

NOTE If the above commands are used to enable the Open/Short compensation function before Open /Short compensation data is measured, an error occurs and the command is ignored.

Fixture Compensation Data Array/Fixture Compensation Coefficient Array

The fixture compensation data array contains Open or Short measurement data in the complex format. This data is used for calculating fixture compensation coefficients. The fixture compensation coefficient array contains fixture compensation coefficients in the complex format. These coefficients are calculated by using the Open or Short measurement data.

The fixture compensation data and coefficient arrays can be read. The fixture compensation coefficient array, once read, can be written back again.

Read Fixture Compensation Data Array

For details on how to read the fixture compensation data array, refer to “Fixture Compensation Data Arrays” on page 127.

Read and Write Fixture Compensation Coefficient Array

For details on how to read and write the fixture compensation coefficient array, refer to “Fixture Compensation Coefficient Arrays” on page 128.

Example program for execution of fixture compensation

After connecting a text fixture, the program shown below enables the fixture compensation function of the fixture compensation kit. In this program, after defining the standard values for the Open/Short state of the fixture compensation kit by using values prepared by the user, the fixture compensation function is enabled by measuring each standard. In addition, when the fixture compensation function is enabled, the internally calculated fixture compensation coefficient is saved in the external controller.

Example program using HTBasic

The program shown in Example 4-5 is saved under the filename com_meas.htb on the programs disk. The details of this program are explained as follows.

Line 80	Sets the GPIB address.
Lines 120 - 130	Substitutes a variable for the type of text fixture and the obtained fixture compensation data point.
Lines 150 - 160	Sets the type of text fixture and the obtained fixture compensation data point.
Lines 200 - 230	When a custom test fixture is selected, defines the electrical length of the test fixture.
Lines 250 - 270	Asks whether to define the standard values for the fixture compensation kit with the values prepared by the user.
Line 280	When each standard value is defined with a value prepared by the user, the program branches to define each standard value for the fixture compensation kit.
Line 300	Without using the list-setting function of the fixture compensation kit, selects a setting that defines each standard value at a common unique value over all frequencies.
Lines 340 - 440	Defines the values of Open (G-C) and Short (R-L). However, each standard value is defined in the sub-program (Inp_data).
Lines 490 - 550	Measures the fixture compensation data for the Open/Short state standard. However, measurement of the fixture compensation data is performed in the function sub-program (FNFixt_comp). Despite whether there is any GPIB error during measurement of the fixture compensation data that comes back as a return value of the function sub-program, when an error is detected, the execution of the fixture compensation is halted at that point.
Lines 590 - 630	Calculates the fixture compensation coefficient and turns on the fixture compensation function. After that, displays completion of execution of the fixture compensation.
Lines 670 - 690	Reads the number of points in a sweep and, using those values, resets the range of array variables used when the fixture compensation coefficient is read.
Lines 710 - 750	Reads the two arrays of fixture compensation coefficients in ASCII transfer format.
Lines 770 - 840	Saves the read arrays of the fixture compensation coefficient in binary format in the external computer. After that, displays completion of

read and write operations of the fixture compensation coefficient.

Lines 940 - 950 Prompts connection of the standard for fixture compensation measurement specified by the variable Standard$ and waits for the input of **[Y]** or **[y]** after the connection.

Line 970 Clears the status byte register and operation status event register.

Lines 980 - 990 Sets the operation status event register bit 7 to 1 only when the operation status condition register bit 7 transits from 1 to 0 (negative transition).

Lines 1000 - 1010 Sets the operation status condition so that register bit 7 is enabled and, upon completion of fixture compensation, sets it so that status byte register bit 7 is enabled.

Lines 1020 - 1030 Sets the branch for SRQ interruption and enables SRQ interruption.

Lines 1040 - 1090 Sends the execute command for the fixture compensation of the standard specified by the variable Standard$ and measures the fixture compensation data.

Lines 1100 - 1110 Displays a message indicating measurement is in progress and waits for completion of the measuring.

Lines 1130 - 1290 Checks whether a GPIB error occurred in the E4991A during measurement. If no error occurred, displays a message indicating completion of measurement and returns a value of 0 from the function sub-program. If an error occurred, displays an error message and a measurement halt message and returns a value of -1 from the function sub-program.

Lines 1340 - 1350 Prompts the input of the standard value of the user-defined fixture compensation kit specified by the variable Mes$ and waits for the input.

Lines 1360 - 1390 Displays the input value and waits for input (made by using the **[Y/N]** keys) on whether it is accurate. If a key other than **[Y]** or **[y]** is pressed, it returns to the first line of the input.

Example 4-5 **Measurement of fixture compensation data (HTBasic)**

```
10      DIM Inp_char$[9],Buff$[9],File$[20]
20      DIM Fix_type$[9],Cal_point$[9]
30      DIM Comp_a(1:801,1:2),Comp_b(1:801,1:2)
40      REAL E_length,Open_g,Open_c,Short_r,Short_l
50      INTEGER Result,Nop_comp,Data_size
60      !
70      CLEAR SCREEN
80      ASSIGN @Agte4991a TO 717
90      !
100     ! Initial Setting
110     !
120     Fix_type$="USER"                    !
USER/FXT16191A/FXT16192A/.....
130     Cal_point$="FIX"                    ! FIX/FUS/USER
140     !
150     OUTPUT @Agte4991a;"SENS:CORR2:FIXT "&Fix_type$
160     OUTPUT @Agte4991a;"SENS:CORR2:COLL:FPO "&Cal_point$
170     !
```

```
180     ! Entry Electrical Length of User's Test Fixture
190     !
200     IF Fix_type$="USER" THEN
210       CALL Inp_data("User's Fixture Electrical
Delay(m)",E_length)
220       OUTPUT @Agte4991a;"SENS:CORR2:FIXT:EDEL:USER:DIST
"&VAL$(E_length)
230     END IF
240     !
250     PRINT "Do you want to entry the comp. standard values?"
260     PRINT
270     INPUT "[Y/N]",Inp_char$
280     IF UPC$(Inp_char$)="Y" THEN
290       !
300       OUTPUT @Agte4991a;"SENS:CORR2:CKIT:LIST OFF"
310       !
320       ! Entry Open Std. Value (G-C)
330       !
340       CALL Inp_data("Open(G)",Open_g)
350       CALL Inp_data("Open(C)",Open_c)
360       OUTPUT @Agte4991a;"SENS:CORR2:CKIT:STAN1:G "&VAL$(Open_g)
370       OUTPUT @Agte4991a;"SENS:CORR2:CKIT:STAN1:C "&VAL$(Open_c)
380       !
390       ! Entry Short Std. Value (R-L)
400       !
410       CALL Inp_data("Short(R)",Short_r)
420       CALL Inp_data("Short(L)",Short_l)
430       OUTPUT @Agte4991a;"SENS:CORR2:CKIT:STAN2:R "&VAL$(Short_r)
440       OUTPUT @Agte4991a;"SENS:CORR2:CKIT:STAN2:L "&VAL$(Short_l)
450     END IF
460     !
470     ! Open Data Measurement
480     !
490     Result=FNFixt_comp(@Agte4991a,"Open")
500     IF Result<>0 THEN Prog_end
510     !
520     ! Short Data Measurement
530     !
540     Result=FNFixt_comp(@Agte4991a,"Short")
550     IF Result<>0 THEN Prog_end
560     !
570     ! Fixture Compensation Done
580     !
590     OUTPUT @Agte4991a;"SENS:CORR2:COLL:SAVE"
600     OUTPUT @Agte4991a;"*OPC?"
610     ENTER @Agte4991a;Buff$
620     PRINT "All Data Measurement Complete"
630     PRINT
640     !
650     ! Fixture Compensation Coefficient Array Reading & Saving
660     !
670     OUTPUT @Agte4991a;"SWE:POIN?"
680     ENTER @Agte4991a;Nop_comp
690     REDIM Comp_a(1:Nop_comp,1:2),Comp_b(1:Nop_comp,1:2)
700     !
710     OUTPUT @Agte4991a;"FORM:DATA ASC"
720     OUTPUT @Agte4991a;"DATA:CMP1?"
730     ENTER @Agte4991a;Comp_a(*)
```

```
740     OUTPUT @Agte4991a;"DATA:CMP2?"
750     ENTER @Agte4991a;Comp_b(*)
760     !
770     File$="COMP_COEF"
780     Data_size=(Nop_comp*2*2)*8
790     CREATE File$,Data_size
800     ASSIGN @File TO File$;FORMAT OFF
810     OUTPUT @File;Comp_a(*),Comp_b(*)
820     ASSIGN @File TO *
830     !
840     PRINT "Compensation Coefficient File Saving Complete"
850     !
860 Prog_end: END
870     !
880     ! Fixture Compensation Data Measurement Function
890     !
900     DEF FNFixt_comp(@Agte4991a,Standard$)
910       DIM Inp_char$[9],Err_mes$[50]
920       INTEGER Err_no
930       !
940       PRINT "Connect "&Standard$&" Standard to electorode plate
on the fixture."
950       INPUT "OK? [Y/N]",Inp_char$
960       IF UPC$(Inp_char$)="Y" THEN
970         OUTPUT @Agte4991a;"*CLS"
980         OUTPUT @Agte4991a;"STAT:OPER:PTR 0"
990         OUTPUT @Agte4991a;"STAT:OPER:NTR 128"
1000        OUTPUT @Agte4991a;"STAT:OPER:ENAB 128"
1010        OUTPUT @Agte4991a;"*SRE 128"
1020        ON INTR 7 GOTO Meas_end
1030        ENABLE INTR 7;2
1040        SELECT Standard$
1050        CASE "Open"
1060          OUTPUT @Agte4991a;"SENS:CORR2:COLL STAN1"
1070        CASE "Short"
1080          OUTPUT @Agte4991a;"SENS:CORR2:COLL STAN2"
1090        END SELECT
1100        DISP "Now measuring..."
1110 Meas_wait: GOTO Meas_wait
1120 Meas_end: DISP
1130        OUTPUT @Agte4991a;"SYST:ERR?"
1140        ENTER @Agte4991a;Err_no,Err_mes$
1150        IF Err_no=0 THEN
1160          PRINT Standard$&" data measurement completion"
1170          PRINT
1180          RETURN 0
1190        ELSE
1200          PRINT "Error: "&Err_mes$
1210          PRINT "Program interruption"
1220          PRINT
1230          RETURN -1
1240        END IF
1250      ELSE
1260        PRINT "Program interruption"
1270        PRINT
1280        RETURN -1
1290      END IF
1300    FNEND
```

```
1310   !
1320   SUB Inp_data(Mes$,Inp_val)
1330     DIM Inp_char$[9]
1340     PRINT "Input "&Mes$
1350 Inp_start: INPUT "Value?",Inp_val
1360     PRINT Mes$&" Value: ";Inp_val
1370     PRINT
1380     INPUT "OK? [Y/N]",Inp_char$
1390     IF UPC$(Inp_char$)<>"Y" THEN Inp_start
1400   SUBEND
```

Example program using macro (E4991A VBA)

The program shown in Example 4-6 is saved under the filename com_meas.bas on the programs disk. The details of this program are explained as follows.

Lines 110 - 120	Substitutes a variable for the type of text fixture and the obtained fixture compensation data point.
Lines 140 - 150	Sets the type of test fixture and the obtained fixture compensation data point.
Lines 170 - 200	When a custom test fixture is selected (defines variable of Fixt_type to USER), defines the electrical length of the test fixture.
Line 220	Asks whether to define the standard values for the fixture compensation kit with the values prepared by the user.
Line 230	When the standard value is defined with the values prepared by the user, the program branches to define each standard value of the fixture compensation kit.
Line 250	Without using the list-setting function of the fixture compensation kit, selects a setting that defines each standard value at a common unique value over all frequencies.
Lines 270 - 350	Defines the standard values of Open (G-C) and Short (R-L). The definition of each standard value is performed in the procedure (Inp_data).
Lines 390 - 430	Measures the fixture compensation data for the Open/Short standard. This measurement is performed in the function program (Fixt_comp). When measurement is aborted during fixture compensation, the function program returns the value of -1 and stops execution of the fixture compensation.
Lines 450 - 470	Calculates the fixture compensation coefficient and turns on the fixture compensation function. After that, displays completion of fixture compensation.
Lines 490 - 530	Reads the two arrays of the fixture compensation coefficients in ASCII transfer format.
Lines 550 - 560	Reads the number of measurement points.
Lines 580 - 690	Saves the two fixture compensation coefficient arrays to a floppy disk. After that, displays completion of transferring the fixture compensation coefficient arrays.
Line 710	Stops the execution of the macro.
Line 790	Prompts connection of the standard for fixture compensation measurement specified by the variable of the Standard.
Lines 840 - 890	Measures the fixture compensation data by the CompenMeasure method after the standard is connected. The CompenMeasure method returns the value of 1 when measurement is completed without problem and the value of 0 when measurement is aborted during fixture compensation.
Lines 900 - 950	Displays a message when measurement is aborted, and the function program returns the value of -1. When measurement is completed

without problem, it returns the value of 0.

Line 970 When the standard is not connected, the function program returns the value of -1.

Lines 1020 - 1060 Inputs the specified data.

Example 4-6 Measurement of fixture compensation data (macro)

```
10      Sub Main()
20        Dim buff As String, file As String
30        Dim Fixt_type As String, Cal_point As String
40        Dim Comp_a As Variant, Comp_b As Variant
50        Dim E_length As Double
60        Dim Open_g As Double, Open_c As Double
70        Dim Short_r As Double, Short_l As Double
80        Dim Result As Integer, Nop_comp As Integer, Inp_char As
Integer
90        Dim iFileNo As Integer, i As Integer
100
110       Fixt_type = "USER"     'USER/FXT16191A/FXT16192A/...
120       Cal_point = "FIX"      'FIX/FUS/USER
130
140       SCPI.Output "SENS:CORR2:FIXT " & Fixt_type
150       SCPI.Output "SENS:CORR2:COLL:FPO " & Cal_point
160
170       If Fixt_type = "USER" Then
180         Call Inp_data("User's Test Fixture Electrical
Length(m)", E_length)
190         SCPI.Output "SENS:CORR2:FIXT:EDEL:USER:DIST " &
CStr(E_length)
200       End If
210
220      Inp_char = MsgBox("Do you want to entry the comp. standard
values?", vbYesNo + vbQuestion, "Compensation")
230       If Inp_char = vbYes Then
240
250         SCPI.Output "SENS:CORR2:CKIT:LIST OFF"
260
270         Call Inp_data("Open_G(S)", Open_g)
280         Call Inp_data("Open_C(F)", Open_c)
290         SCPI.Output "SENS:CORR2:CKIT:STAN1:G " & CStr(Open_g)
300         SCPI.Output "SENS:CORR2:CKIT:STAN1:C " & CStr(Open_c)
310
320         Call Inp_data("Short_R(ohm)", Short_r)
330         Call Inp_data("Short_L(H)", Short_l)
340         SCPI.Output "SENS:CORR2:CKIT:STAN2:R " & CStr(Short_r)
350         SCPI.Output "SENS:CORR2:CKIT:STAN2:L " & CStr(Short_l)
360
370       End If
380
390       Result = Fixt_comp("Open")
400       If Result <> 0 Then GoTo Prog_end
410
420       Result = Fixt_comp("Short")
430       If Result <> 0 Then GoTo Prog_end
440
450       SCPI.Output "SENS:CORR2:COLL:SAVE"
460       buff = SCPI.Query("*OPC?")
```

```
470       MsgBox "All compen-data measurement completion", vbOKOnly,
"Compensation"
480
490        SCPI.Output "FORM:DATA ASC"
500        SCPI.Output "DATA:CMP1?"
510        SCPI.Enter Comp_a, "#"
520        SCPI.Output "DATA:CMP2?"
530        SCPI.Enter Comp_b, "#"
540
550        SCPI.Output "SWE:POIN?"
560        SCPI.Enter Nop_comp
570
580        iFileNo = FreeFile
590        file = "COMP_COEF"
600        Open file For Output As iFileNo
610        For i = 0 To Nop_comp - 1
620          Write #iFileNo, Val(Comp_a(2 * i)), Val(Comp_a(2 * i +
1))
630        Next i
640
650        For i = 0 To Nop_comp - 1
660          Write #iFileNo, Val(Comp_b(2 * i)), Val(Comp_b(2 * i +
1))
670        Next i
680        Close #iFileNo
690       MsgBox "Saving Compensation Coefficient File Completion",
vbOKOnly, "Compensation"
700
710     Prog_end: End
720
730         End Sub
740
750     Function Fixt_comp(Standard As String) As Integer
760       Dim Inp_char As Integer
770       Dim bool As Long
780
790       Inp_char = MsgBox("Connect " & Standard & _
800                         " standard to electrode plate on the test
fixture.", _
810                             vbOKCancel, "Compensation")
820
830       If Inp_char = vbOK Then
840         Select Case Standard
850         Case "Open"
860           bool = CompenMeasure(CompenOpen)
870         Case "Short"
880           bool = CompenMeasure(CompenShort)
890         End Select
900         If bool = 0 Then
910           MsgBox Standard & " Compensation aborted!", vbOKOnly,
"Compensation"
920           Fixt_comp = -1
930         Else
940           Fixt_comp = 0
950         End If
960       Else
970         Fixt_comp = -1
980       End If
```

```
990
1000    End Function
1010
1020    Sub Inp_data(Mes As String, Inp_val As Double)
1030
1040      Inp_val = Val(InputBox(Mes, "Input values"))
1050
1060    End Sub
```

5 Measurement Start and Detection of Measurement End

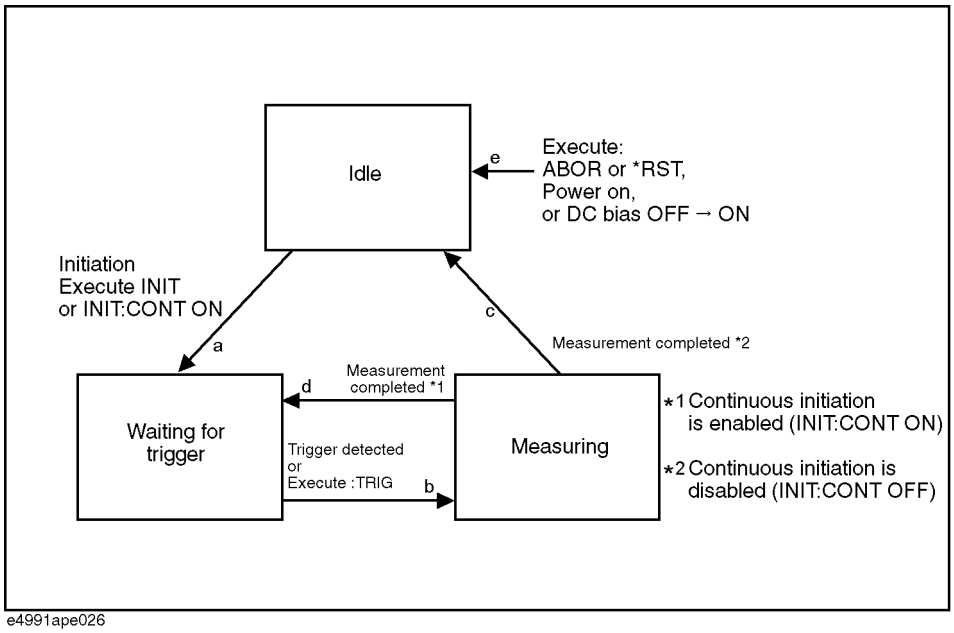
This chapter explains how to prepare a trigger for starting measurement and detecting the end of measurement with the Agilent E4991A.

Measurement Trigger (Measurement Start)

Trigger System

The E4991A trigger system has three states: “Idle,” “Waiting for trigger,” and “Measuring.” as shown in Figure 5-1.

Figure 5-1 **Trigger System**



The following section explains the state transitions of the trigger system.

Idle State

Immediately after the E4991A is powered on, the trigger system is in the Idle state. However, the trigger system soon transits to the Waiting for trigger state because the trigger system’s continuous initiation feature is enabled and the trigger source is set to internal trigger. After that, the E4991A transits between the Measuring and Waiting for trigger states. Also, when one of the following GPIB commands is executed, the trigger system transits to the Idle state.

- ***RST** on page 282
- **ABOR** on page 286

When the dc bias function has been switched from disabled to enabled, the trigger system transits to the Idle state.

If the trigger system has been initiated using the following GPIB command, the state changes from Idle to Waiting for trigger.

- **INIT** on page 382
- **INIT:CONT** on page 382

Waiting for Trigger State (Trigger Detection State)

When a trigger is made (detected) or the command for **TRIG** on page 525 is executed during Waiting for trigger, the trigger system transits to the Measurement state and measurement (sweep) starts. How a trigger is made depends on the trigger source setting. Use the following GPIB command to set the trigger source.

- **TRIG:SOUR** on page 526

Trigger source setting	How to make a trigger
Internal trigger (INT)	An internal trigger is made automatically.
External trigger (EXT)*1	When a trigger signal is input via the EXT TRIGGER connector on the rear panel, a trigger is made.
GPIB trigger (BUS)	When ***TRG** on page 284 is executed, a trigger is made.
Manual trigger (MAN)	When the **[Trigger]** key is pressed on the front panel, a trigger is made.

*1. When an external trigger is selected, the command for **TRIG:SLOP** on page 526 can be used to set the polarity (positive/negative) of a trigger signal input through the EXT TRIGGER connector.

Use the following GPIB command to set the trigger detection points.

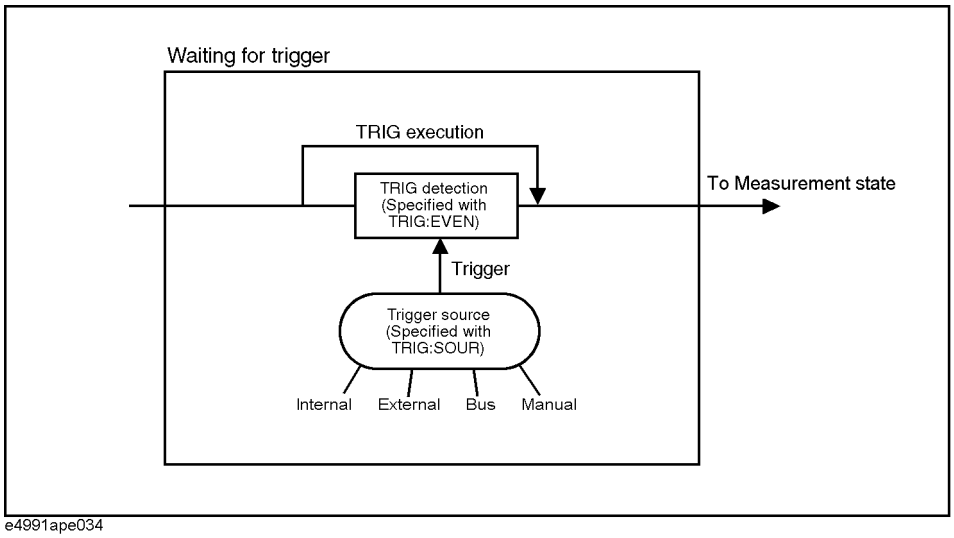
- **TRIG:EVEN** on page 525

Trigger detection points	Description
For each sweep	When a trigger event is detected, sweep is performed once. If sweep averaging is enabled, sweep is performed the same number of times as that of sweep averaging.
For each measurement point	When a trigger event is detected, measurement is performed at each measurement point.
For each segment	When a trigger event is detected during segment sweep, sweep is performed for each segment.

NOTE

Even with sweep averaging set to enabled and the trigger detection point set to “for each sweep,” by making a trigger first or by executing the **TRIG** command, sweep is repeated until the number of times specified for sweep averaging is completed.

Figure 5-2 **Transition from Waiting for Trigger to Measuring**



Measurement State

If delay time is specified in the Measurement state, measurement (sweep) starts after the specified delay time has elapsed.

When all of the measurements are completed, depending on the setting of the trigger system's continuous initiation (**INIT:CONT**), the trigger system transits as follows.

Continuous initiation OFF: Transits to Idle state.

Continuous initiation ON: Transits to Waiting for trigger state.

Trigger Measurement

Continuous Measurement (making a trigger automatically and continuously)

Step 1. Use the **TRIG:SOUR** command to set the trigger source to internal trigger.

Step 2. If the trigger system is not initiated (in Idle state), use the **INIT:CONT** command to enable the trigger system's continuous initiation.

Measurement at any time (making a trigger from an external controller)

Step 1. Use the **TRIG:SOUR** command to set the trigger source to GPIB trigger.

Step 2. If the trigger system is not initiated (in Idle state), use the **INIT:CONT** command to enable the trigger system's continuous initiation.

Step 3. Make a trigger at any time. The following two GPIB commands can be used to make a trigger from an external controller as shown in the following table.

Command	Trigger source setting
***TRG** on page 284	GPIB (BUS) trigger
TRIG on page 525	Manual, External or GPIB (BUS) trigger

Step 4. Repeat Step 3 to repeat measurement.

Alternatively, you can follow the procedure below to perform measurement at any time.

Step 1. If the trigger system is already initiated (in a state other than Idle), use the **ABOR** command to terminate the trigger system.

Step 2. Use the **TRIG:SOUR** command to set the trigger source to internal trigger.

Step 3. Use the **INIT** command at any time to initiate the trigger system; a trigger is automatically made by an internal source and measurement is performed once.

Step 4. Repeat Step 3 to repeat measurement.

Waiting for Measurement End (Detection of Sweep End)

Using the Status Register

The state of the E4991A can be monitored through status registers. This section explains how to detect measurement end by using status registers. For details on the status report system, including bit configuration of status registers, see B, “GPIB Status Report System,” on page 555.

The Operation Status Event Register (see Table B-3 on page 565) indicates a measurement state. A Service Request (SRQ) is useful for detecting a measurement termination based on this information.

Use one of the following commands to detect a measurement end by using SRQ.

- ***SRE** on page 283
- **STAT:OPER:ENAB** on page 490
- **STAT:OPER:PTR** on page 492
- **STAT:OPER:NTR** on page 491

Perform the following procedure to detect a measurement end.

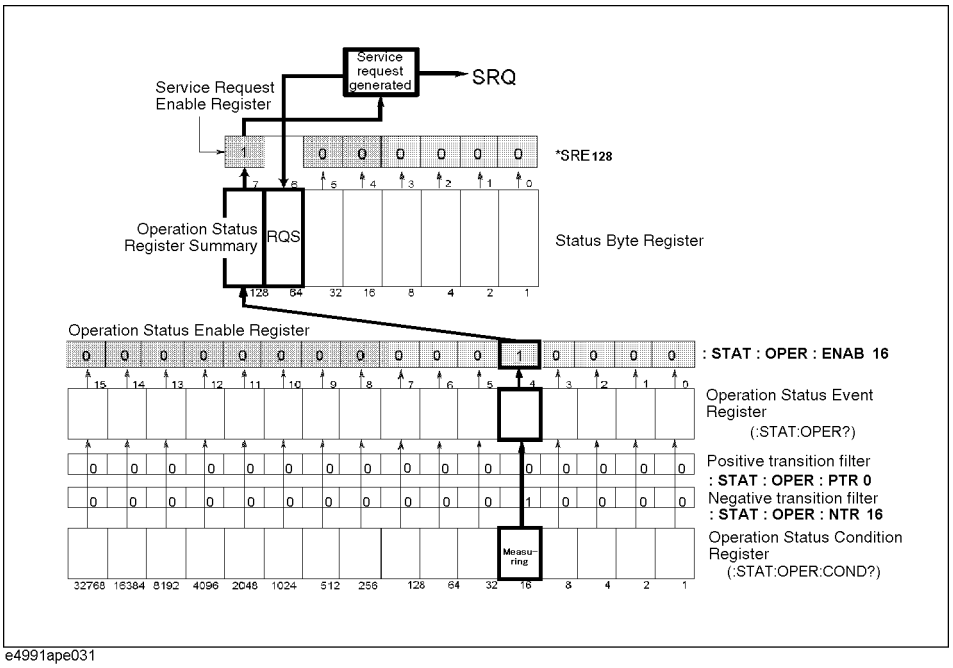
Step 1. Configure the E4991A to generate an SRQ when the Measuring bit (set to 1 during measurement) in the Operation Status Event Register changes from 1 to 0.

Step 2. Make a trigger to start measurement.

Step 3. When the SRQ is generated, an interrupt is executed in the program.

NOTE If sweep averaging is enabled, the E4991A generates an SRQ after measurement is made the same number of times as that of the sweep averaging specified.

Figure 5-3 **SRQ Generation Sequence (at measurement end)**



e4991ape031

Adding Wait Time

The user can have a controller wait until the E4991A completes measurement by using, for example, the WAIT command in HTBasic. Using this command is very simple, but if the wait time is improperly set, an unexpected error may result.

Example Programs for Detecting Measurement End

The following example programs can be used for the detection of measurement end.

Example program using HTBasic (SRQ)

Example 5-1 shows an example program for detecting measurement end by using an SRQ. After setting the number of times for sweep averaging at 4 and setting the SRQ, a sweep is performed four times. Then, when the SRQ for the measurement end occurs, a message indicating completion is displayed and the program ends. This program is saved under the filename sweep.htb on the sample programs disk. The details of the program are explained below.

Line 50	Sets the GPIB address of the E4991A.
Lines 70 - 80	Substitutes variables for the trace number and the number of sweep averaging.
Lines 100 - 120	Turns on Trace 1 and activates the sweep averaging function.
Lines 140 - 160	Sets the trigger source for the internal trigger and turns off the continuous activation of the trigger system. Then, resets the trigger system and sets the trigger sequence to the idle state.
Line 180	Performs a sweep and calls the sub-program for detecting measurement end.
Lines 260 - 280	Reads the on/off status of the sweep averaging function and substitutes a variable for the status. Next, when the sweep averaging function is turned on, resets the averaging and returns the averaging counter to zero.
Lines 300 - 310	Set so that only when the operation status condition register bit 4 transits from 1 to 0 (negative transition), the operation status event register bit 4 is set at 1.
Lines 320 - 330	Sets the instrument so that the operation status event register bit 4 is enabled and the status byte register bit 7 is effective.

NOTE The bit indicating measurement in progress when calibration and fixture compensation data are measured is prepared separately from other bits indicating a measurement in progress. To detect the completion of these, set the instrument so that the operation status condition register bit 0 is enabled.

NOTE When the sweep averaging function is set on, the measurement end is detected upon completion of the specified number of times for averaging.

Lines 340 -360	Clears the status byte register and operation status register.
Lines 380 - 390	Sets the branch for the SRQ interruption and enables the SRQ interruption.
Line 400	Starts measurement.
Line 420	Waits for the completion of measurement.

Lines 430 - 440 Indicates measurement end and disables the SRQ interruption.

Example 5-1 Detection of measurement end using the SRQ

```
10     DIM Buff$[9]
20     INTEGER Trc,Swp_count
30     !
40     CLEAR SCREEN
50     ASSIGN @Agte4991a TO 717
60     !
70     Trc=1
80     Swp_count=4
90     !
100    OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc)&" ON"
110    OUTPUT @Agte4991a;"CALC:AVER:COUN "&VAL$(Swp_count)
120    OUTPUT @Agte4991a;"CALC:AVER ON"
130    !
140    OUTPUT @Agte4991a;"TRIG:SOUR INT"
150    OUTPUT @Agte4991a;"INIT:CONT OFF"
160    OUTPUT @Agte4991a;"ABOR"
170    !
180    CALL Sweep(@Agte4991a)
190    !
200    END
210    !
220    SUB Sweep(@Agte4991a)
230      DIM Buff$[9]
240      INTEGER Swp_bool
250      !
260      OUTPUT @Agte4991a;"CALC:AVER?"
270      ENTER @Agte4991a;Swp_bool
280      IF Swp_bool=1 THEN OUTPUT @Agte4991a;"CALC:AVER:CLE"
290      !
300      OUTPUT @Agte4991a;"STAT:OPER:PTR 0"
310      OUTPUT @Agte4991a;"STAT:OPER:NTR 16"
320      OUTPUT @Agte4991a;"STAT:OPER:ENAB 16"
330      OUTPUT @Agte4991a;"*SRE 128"
340      OUTPUT @Agte4991a;"*CLS"
350      OUTPUT @Agte4991a;"*OPC?"
360      ENTER @Agte4991a;Buff$
370      !
380      ON INTR 7 GOTO Swp_end
390      ENABLE INTR 7;2
400      OUTPUT @Agte4991a;"INIT"
410      DISP "Now Measuring..."
420 Swp_wait: GOTO Swp_wait
430 Swp_end: DISP "Sweep Complete"
440      OFF INTR 7
450    SUBEND
```

Example program using macro (E4991A VBA)

You are not able to use an SRQ in the macro program (E4991A VBA), which uses the **SingleMeasure method** instead of an SRQ. Example 5-2 shows an example program for detecting measurement end by using the **SingleMeasure method**. After setting the number of sweep averaging to 4, start a sweep by executing **SingleMeasure method**. **SingleMeasure method** waits until sweep has been completed. Then, when the sweep is completed, a message of completion is displayed, and the program ends. This program is saved under the filename sweep.bas on the sample programs disk. Below is an explanation of the details of the program.

Lines 50 - 60	Substitutes variables for the trace number and the number of sweep averaging.
Lines 100 - 130	Turns on Trace 1 and activates the sweep averaging function.
Lines 150 - 170	Sets the trigger source for the internal trigger and turns off the continuous activation of the trigger system. Then, resets the trigger system and sets the trigger sequence to the idle state.
Lines 190 - 200	Resets sweep averaging when the sweep averaging function is set to on.
Line 220	Starts the sweep and substitutes a variable of “bool” for sweep completion.

NOTE When the sweep averaging function is set on, the measurement end is detected upon completion of the specified number of averaging.

Line 230	Displays a message of “Sweep Aborted” when sweep is aborted (bool=0) during the measurement.
Line 250	Stops the execution of the macro.

Example 5-2 Detection of measurement end using the SingleMeasure method

```
10      Sub Sweep()
20        Dim trc As Integer
30        Dim swp_count As Integer, swp_bool As Integer, bool As
Integer
40
50        trc = 1
60        swp_count = 4
70
80        ' E4991A settings
90
100       SCPI.Output "*CLS"
110       SCPI.Output "DISP:TRAC" & CStr(trc) & " ON"
120       SCPI.Output "CALC:AVER:COUN " & CStr(swp_count)
130       SCPI.Output "CALC:AVER ON"
140
150       SCPI.Output "TRIG:SOUR INT"
160       SCPI.Output "INIT:CONT OFF"
170       SCPI.Output "ABOR"
180
190       swp_bool = SCPI.Query("CALC:AVER?")
200       If swp_bool = 1 Then SCPI.Output "CALC:AVER:CLE"
210
```

```
220       bool = SingleMeasure
230       If bool = 0 Then MsgBox ("Sweep Aborted")
240
250       End
260
270     End Sub
```

6 Read and Write Measurement Data

This chapter explains how to read and write Agilent E4991A measurement data.

Data Transfer Format

When a measurement condition setting is read from the E4991A, for example, when the **FREQ:STAR** command in the query format is used to read a sweep start frequency value, the ASCII format is used regardless of the data transfer format setting.

On the other hand, when simulation results of frequency characteristics are read during data measurement or equivalent circuit analysis, for example, when the **CALC{1-5}:DATA?** command is used to read a data trace array, either the ASCII (default) or binary format can be used. The binary formats include IEEE 32- and 64-bit floating point formats. Depending on the controller used, choose the appropriate format. Use the following GPIB command to select a data transfer format. When the binary format is selected, byte transfer order (byte order) can be specified.

- **FORM:DATA** on page 374

ASCII Format

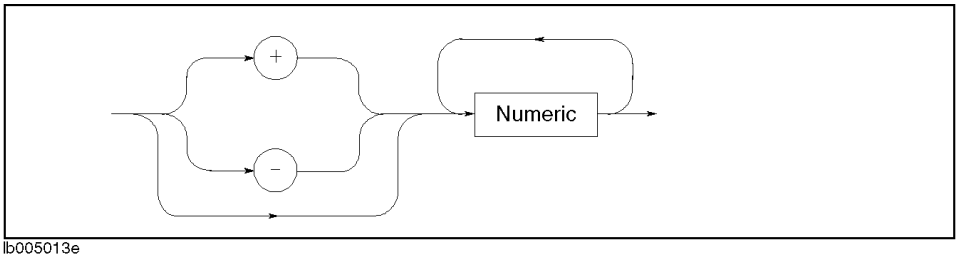
When data is read in the ASCII data transfer format, numeric values are transferred as ASCII bytes in one of the following formats. They are delimited by commas (,) in accordance with the IEEE488.2 specifications.

NOTE Strings representing numeric values vary in length. Therefore, when each string is read from a comma-delimited list, commas do not appear in fixed positions.

- Integer Format

  Figure 6-1 shows the integer format. A numeric value is represented as an integer. For example, a numeric 201 is expressed as “+201” or “201”.

Figure 6-1 Integer Format

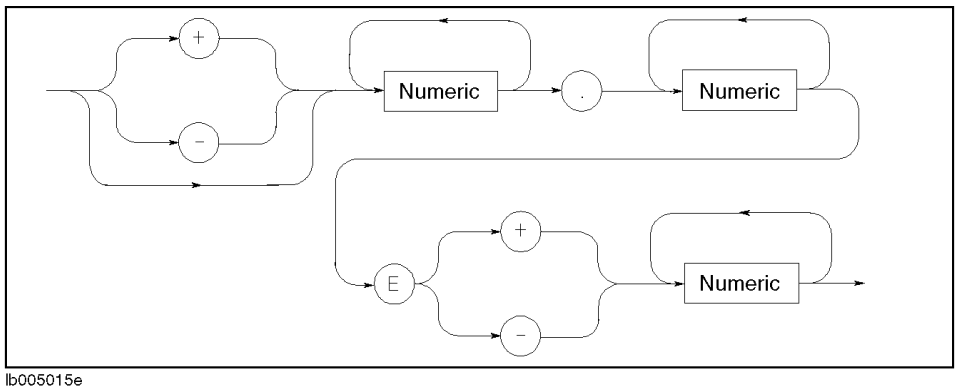


lb005013e

- Floating Point Format

  Figure 6-2 shows the floating point format. A numeric value is represented as a floating point. For example, the numeric 1000 is expressed as “1.0E3”.

Figure 6-2 **Floating Point Format**

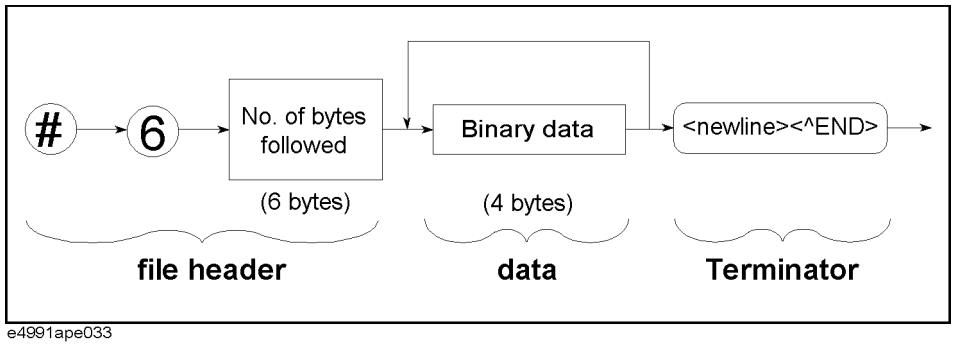


lb005015e

IEEE 32-Bit Floating Point Format

In this format, a numeric consists of four bytes. Therefore, assuming that one measurement point consists of two pieces of a numeric, when 201 measurement points are transferred, the total data length is 1608 bytes. A numeric is transferred into the format shown in Figure 6-3.

Figure 6-3 **IEEE 32-Bit Floating Point Data Transfer Format**

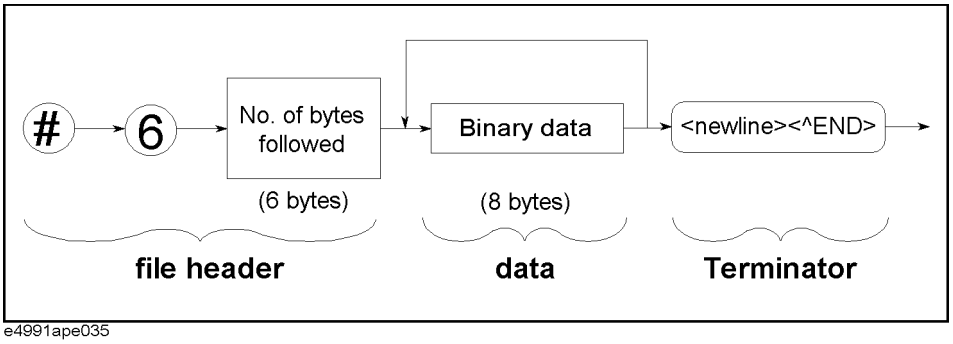


e4991ape033

IEEE 64-Bit Floating Point Format

In this format, a numeric consists of eight bytes. Therefore, assuming that one measurement point consists of two pieces of a numeric, when 201 measurement points are transferred, the total data length is 3216 bytes. The numeric is transferred in the format shown in Figure 6-4.

Figure 6-4 **IEEE 64-Bit Floating Point Data Transfer Format**



e4991ape035

Specify Byte Order (Binary Transfer)

When one of the binary formats is selected as the data transfer format, the following GPIB command can be used to specify the order in which each byte is transferred.

- **FORM:BORD** on page 373

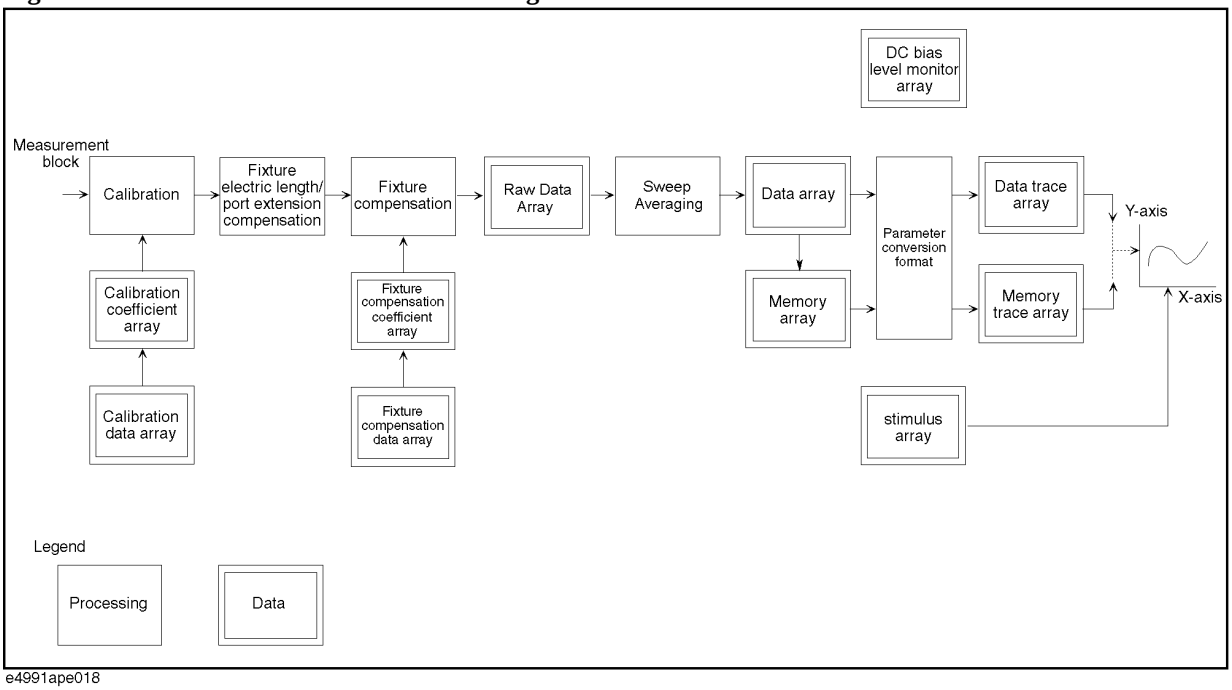
For example, when data written in the IEEE 32-bit floating point format is read on a computer running MS-DOS, by reversing the order in which bytes are read with the above GPIB command, reformatting the data on the computer is not necessary.

Internal Data Flow

Data Processing Flow

Figure 6-5 shows an overview of the E4991A internal data processing flow.

Figure 6-5 E4991A Data Processing Flow



e4991ape018

The following section explains the internal data arrays show in Figure 6-5.

Internal Data Arrays

Raw Data Array

The raw data array contains the results of calibration, fixture electrical length/port extension compensation, and fixture compensation performed on the measured raw data. It is stored as a complex format (R-X). Use the following GPIB command to read the raw data array.

- **DATA:RAW?** on page 349

Data Array

The data array contains the results of the sweep averaging performed on the raw data array. It is stored as a complex format (R-X).

Reading or writing the data array is not allowed.

Memory Array

The memory array contains the copied data array.

Reading or writing the memory array is not allowed.

Data Trace Array

The data trace array contains the number of measurement points of results obtained by measurement parameter conversion on the data array. For a scalar trace, results are stored in the real format, and for a complex trace, results are in the complex format. In addition, if data operations are performed between the data and memory trace arrays, the data trace array contains the results. Use the following GPIB command to read the data trace array.

- **CALC{1-5}:DATA?** on page 293

Writing the data trace array is not allowed.

Memory Trace Array

The memory trace array contains the number of measurement points of results obtained by measurement parameter conversion on the memory array. For a scalar trace, results are stored in the real format, and for a complex trace, results are in the complex format. In addition, when the equivalent circuit analysis function is used, the memory trace array contains the simulation results of frequency characteristics. Use the following GPIB command to read the memory trace array.

- **CALC{1-5}:DATA?** on page 293

Writing the memory trace array is not allowed.

Stimulus Array

The stimulus array contains stimulus values of all measurement points. Use the following GPIB command to read the stimulus array.

- **SWE:STIM{1-4}?** on page 512

Writing the stimulus array is not allowed.

DC Bias Level Monitor Array

The dc bias level monitor array contains dc bias voltage or current level monitor values in the real format. Use the following GPIB command to read the dc bias level monitor array.

- **CALC:DATA:MON?** on page 292

Writing the dc bias level monitor array is not allowed.

Calibration Data Arrays

The calibration data arrays contain Open/Short/Load/Low-loss capacitor measurement data in the complex format. This data is used to calculate calibration coefficients. There are eight arrays containing Open/Short/Load/Low-loss capacitor measurement data.

Use the following GPIB command to read the calibration data array.

- **DATA:CAD{1-8}?** on page 345

When the sweep type is set to segment sweep, the following GPIB command can be used to read the calibration data array for each specified segment.

- **DATA:SEGM{1-16}:CAD{1-8}?** on page 350

Note that the above GPIB commands can be used to read a calibration data array measured with the calibration data measurement points of “User-defined frequency points and User-defined power points.”

Writing the calibration data array is not allowed.

Array number*1	Contained data
1	Open measurement data 1 for calculating calibration coefficients.
2	Short measurement data 1 for calculating calibration coefficients.
3	Load measurement data 1 for calculating calibration coefficients.
4	Low-loss capacitor measurement data 1 for calculating calibration coefficients.
5	Open measurement data 2 for calculating calibration coefficients.
6	Short measurement data 2 for calculating calibration coefficients.
7	Load measurement data 2 for calculating calibration coefficients.
8	Low-loss capacitor measurement data 2 for calculating calibration coefficients.

*1. This number corresponds to the number specified at the end of the command.

Calibration Coefficient Arrays

The calibration coefficient arrays contain calibration coefficients in the complex format. These were calculated using a calibration data array. As shown in the following table, there are six arrays containing calibration coefficients: A1, B1, C1, A2, B2, and C2.

Use the following GPIB command to read or write a calibration coefficient array.

- **DATA:CCO{1-6}** on page 346

For segment sweep, the following GPIB command can be used to read or write a calibration coefficient array for each specified segment.

- **DATA:SEGM{1-16}:CCO{1-6}** on page 351

Array number*1	Contained data
1	Calibration coefficient A1
2	Calibration coefficient B1
3	Calibration coefficient C1
4	Calibration coefficient A2
5	Calibration coefficient B2
6	Calibration coefficient C2

*1. This number corresponds to the number specified at the end of the command.

NOTE

Before writing all of the calibration coefficient arrays, set the measurement frequency and oscillator level to the same values specified when they were read and enable the calibration function. Note that if calibration is disabled, it cannot be enabled until Open/Short/Load calibration data are measured. Therefore, calibration data must be measured before calibration coefficient arrays are written. However, measuring actual calibration data is not necessary. Accordingly, you can measure calibration data without connecting a calibration standard and then enable calibration.

After performing measurement using the written calibration coefficient arrays, if stimulus values are changed, the calibration coefficient arrays are written again, resulting in incorrect measurement regardless of whether calibration is enabled or disabled.

Fixture Compensation Data Arrays

The fixture compensation data array contains Open/Short measurement data in the complex format. This data is used to calculate fixture compensation coefficients. There are two arrays containing Open/Short measurement data.

Use the following GPIB command to read the fixture compensation data array.

- **DATA:CMD{1-2}?** on page 347

When the sweep type is set to segment sweep, the following GPIB command can be used to read the fixture compensation data array for each specified segment.

- **DATA:SEGM{1-16}:CMD{1-2}?** on page 352

Note that the above GPIB commands can be used to read fixture compensation data arrays measured with the fixture compensation data measurement points of “User-defined frequency points” and “User-defined power points.”

Writing the fixture compensation data array is not allowed.

Array number*1	Contained data
1	Open measurement data for calculating fixture compensation coefficients.
2	Short measurement data for calculating fixture compensation coefficients.

*1. This number corresponds to the number specified at the end of the command.

Fixture Compensation Coefficient Arrays

The fixture compensation coefficient array contains fixture compensation coefficients in the complex format. These were calculated using a fixture compensation data array. As shown in the following table, there are three arrays containing fixture compensation coefficients A, B, and C.

Use the following GPIB command to read or write a fixture compensation coefficient array.

- **DATA:CMP{1-3}** on page 348

When the sweep type is set to segment sweep, use the following GPIB command to read or write a fixture compensation coefficient array.

- **DATA:SEGM{1-16}:CMP{1-3}** on page 353

Array number*1	Contained data
1	Fixture Compensation coefficient A
2	Fixture Compensation coefficient B
3	Fixture Compensation coefficient C

*1. This number corresponds to the number specified at the end of the command.

NOTE

Before writing all of the fixture compensation coefficient arrays, set the measurement frequency and oscillator level to the same values specified when they were read and enable the fixture compensation function. Note that if fixture compensation is disabled, it cannot be enabled until Open/Short fixture compensation data is measured. Therefore, fixture compensation data must be measured before fixture compensation coefficient arrays are written. However, measuring actual fixture compensation data is not necessary. Accordingly, you can measure fixture compensation data without connecting a fixture compensation standard and then enable fixture compensation.

After performing measurement using the written fixture compensation coefficient arrays, if stimulus values are changed, or if fixture compensation is switched between enabled and disabled, the fixture compensation arrays are written again, resulting in incorrect measurement regardless of whether fixture compensation is enabled or disabled.

Timing for read/write

When a read command is executed during a sweep, the data at the time the command is executed is read. Therefore, in order to obtain correct measured data, it is necessary to execute the command for data read after waiting for the completion of the sweep. In cases in which the program execution speed is considered, the read command should be synchronized with the completion of the sweep and executed upon its completion. In order to synchronize with the completion of the sweep, use the status report system. Refer to “Example Programs for Detecting Measurement End” on page 114 for details.

Example Programs for Reading Internal Data Arrays

Reading the data trace array (ASCII format)

An example program for reading the data trace array is shown. In the program, the data trace array is read in ASCII transfer format.

Example program using HTBasic

The program shown in Example 6-1 is saved under the filename asc_read.htb on the sample programs disk. Below is an explanation of the program's details.

Line 50	Sets the GPIB address
Lines 70 - 80	Substitutes variables for the trace number and measurement point.
Line 120	Resets the E4991A.
Lines 140 - 150	Turns on Trace 1 and sets the measurement point.
Lines 170 - 190	Sets the trigger source to the internal trigger and turns off the continuous activation of the trigger system. Then, it resets the trigger system, and sets the trigger sequence to the idle state.
Line 210	Calls the sub-program that executes a sweep.
Line 230	Executes auto-scale adjustment of the trace.
Line 250	Sets the data transfer format to ASCII transfer format.
Lines 270 - 300	Reads the data trace array and stimulus array.
Lines 340 - 570	Refer to "Example Programs for Detecting Measurement End" on page 114 for an explanation of the sub-program.

Example 6-1 **Reading the data trace array**

```
10      DIM Meas_data(1:201),Swp_prm(1:201)
20      INTEGER Trc1,Nop
30      !
40      CLEAR SCREEN
50      ASSIGN @Agte4991a TO 717
60      !
70      Trc1=1
80      Nop=201
90      !
100     ! E4991A settings
110     !
120     OUTPUT @Agte4991a;"SYST:PRES"
130     !
140     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&" ON"
150     OUTPUT @Agte4991a;"SWE:POIN "&VAL$(Nop)
160     !
170     OUTPUT @Agte4991a;"TRIG:SOUR INT"
180     OUTPUT @Agte4991a;"INIT:CONT OFF"
190     OUTPUT @Agte4991a;"ABOR"
200     !
210     CALL Sweep(@Agte4991a)
```

```
220     !
230     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&":Y:AUTO"
240     !
250     OUTPUT @Agte4991a;"FORM:DATA ASC"
260     !
270     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":DATA? FDATA"
280     ENTER @Agte4991a;Meas_data(*)
290     OUTPUT @Agte4991a;"SWE:STIM1?"
300     ENTER @Agte4991a;Swp_prm(*)
310     !
320     END
330     !
340     SUB Sweep(@Agte4991a)
350       DIM Buff$[9]
360       INTEGER Swp_bool
370       !
380       OUTPUT @Agte4991a;"CALC:AVER?"
390       ENTER @Agte4991a;Swp_bool
400       IF Swp_bool=1 THEN OUTPUT @Agte4991a;"CALC:AVER:CLE"
410       !
420       OUTPUT @Agte4991a;"STAT:OPER:PTR 0"
430       OUTPUT @Agte4991a;"STAT:OPER:NTR 16"
440       OUTPUT @Agte4991a;"STAT:OPER:ENAB 16"
450       OUTPUT @Agte4991a;"*SRE 128"
460       OUTPUT @Agte4991a;"*CLS"
470       OUTPUT @Agte4991a;"*OPC?"
480       ENTER @Agte4991a;Buff$
490       !
500       ON INTR 7 GOTO Swp_end
510       ENABLE INTR 7;2
520       OUTPUT @Agte4991a;"INIT"
530       DISP "Now Measuring..."
540 Swp_wait: GOTO Swp_wait
550 Swp_end: DISP "Sweep Complete"
560       OFF INTR 7
570     SUBEND
```

Example program using macro (E4991A VBA)

The program shown in Example 6-2 is saved under the filename asc_read.bas on the sample programs disk. Below is an explanation of the program's details.

Lines 60 - 70	Substitutes variables for the trace number and number of measurement points.
Line 110	Resets the E4991A.
Lines 130 - 140	Turns on Trace 1 and sets the measurement point.
Lines 160 - 180	Sets the trigger source to the internal trigger and turns off the continuous activation of the trigger system. Then, it resets the trigger system and sets the trigger sequence to the idle state.
Lines 200 - 210	Resets the sweep averaging when sweep averaging function is set to on.
Line 230	Starts the sweeps and substitutes a variable of "bool" for sweep completion.
Lines 250 - 260	Displays a message of "Sweep Aborted" when sweep is aborted (bool=0) during the measurement.
Line 270	Describes the program routine below this line when sweep is completed without problem (bool=1).
Line 280	Executes auto-scale adjustment of the trace.
Line 300	Sets the data transfer format to ASCII transfer format.
Lines 320 - 350	Reads the data trace array and stimulus array.
Lines 340 - 570	Stops execution of the macro.

Example 6-2 **Read of the data trace array**

```
10      Sub Main()
20        Dim meas_data As Variant, swp_prm As Variant
30        Dim trc1 As Integer, nop As Integer
40        Dim swp_bool As Integer, bool As Integer
50
60        trc1 = 1
70        nop = 201
80
90        ' E4991A settings
100
110       SCPI.Output "SYST:PRES"
120
130       SCPI.Output "DISP:TRAC" & CStr(trc1) & " ON"
140       SCPI.Output "SWE:POIN " & CStr(nop)
150
160       SCPI.Output "TRIG:SOUR INT"
170       SCPI.Output "INIT:CONT OFF"
180       SCPI.Output "ABOR"
190
200       swp_bool = SCPI.Query("CALC:AVER?")
210       If swp_bool = 1 Then SCPI.Output "CALC:AVER:CLE"
220
230       bool = SingleMeasure
240
```

```
250       If bool = 0 Then
260         MsgBox ("Sweep Aborted")
270       ElseIf bool = 1 Then
280         SCPI.Output "DISP:TRAC" & CStr(trc1) & ":Y:AUTO"
290
300         SCPI.Output "FORM:DATA ASC"
310
320         SCPI.Output "CALC" & CStr(trc1) & ":DATA? FDATA"
330         SCPI.Enter meas_data, "#"
340         SCPI.Output "SWE:STIM3?"
350         SCPI.Enter swp_prm, "#"
360       End If
370
380       End
390     End Sub
```

Reading the dc bias level monitor array

By using the dc bias monitor function, the example program shown below can read the monitor value at each measurement point.

Example program using HTBasic

The dc bias monitor value taken during the dc bias voltage sweep is read in binary transfer format (IEEE 64-bit floating-point) and the results are displayed. The program shown in Example 6-3 is saved under the filename bias_mon.htb on the sample programs disk. Below is an explanation of the program's details.

Lines 100 - 110	Sets the GPIB address.
Lines 130 - 210	Substitutes variables for the trace number, dc bias voltage sweep range, number of measurement points, sweep averaging factor, and CW frequency and level value of the signal source.
Line 250	Resets the E4991A.
Lines 270 - 290	Turns on Trace 1 and sets the measurement parameter to impedance. In addition, turns off Trace 2.
Lines 310 - 380	Sets the sweep parameter for the dc bias voltage sweep. Next, sets the sweep range, number of measurement points, sweep direction, and sweep averaging function.
Lines 400 - 420	Sets the CW frequency of the signal source, the mode of the oscillator level, and the level value.
Lines 440 - 450	Turns on the dc bias output and the monitor function. However, when using the monitor function, due to the necessity of setting the marker function in advance, marker 1 is set on.
Lines 480 - 500	Sets the trigger source in the internal trigger and turns off the continuous activation of the trigger system.Then, resets the trigger system and sets the trigger sequence to the idle state.
Line 520	Calls the sub-program to execute a sweep.
Line 540	Sets the data transfer format to IEEE 64-bit floating-point format.
Lines 560 - 590	Reads out the data trace array.
Lines 610 - 640	Reads out the dc bias level monitor array.
Lines 660 - 690	Reads out the stimulus array.
Lines 710 - 770	Displays the measurement values and the dc bias monitor values.
Lines 810 - 1040	Refer to "Example Programs for Detecting Measurement End" on page 114 for an explanation of the sub-program.

Example 6-3 Reading the monitor value

```
10      DIM Meas_data(1:41),Mon_bias(1:41),Swp_prm(1:41)
20      DIM Header$[9],Buff$[9],Img$[30]
30      DIM Start_bias$[9],Stop_bias$[9],Lim_bias$[9]
40      DIM Cw_freq$[9],Osc_level$[9]
50      INTEGER Trc1,Trac2,Nop,Swp_count,I
70      !
80      CLEAR SCREEN
```

```
90      !
100     ASSIGN @Agte4991a TO 717
110     ASSIGN @Binary TO 717;FORMAT OFF
120     !
130     Trc1=1
140     Trc2=2
150     Start_bias$="0V"
160     Stop_bias$="40V"
170     Lim_bias$="50MA"
180     Nop=41
190     Swp_count=1
200     Cw_freq$="100MHZ"
210     Osc_level$="0.1V"
220     !
230     ! E4991A settings
240     !
250     OUTPUT @Agte4991a;"SYST:PRES"
260     !
270     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&" ON"
280     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc2)&" OFF"
290     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":FORM Z"
300     !
310     OUTPUT @Agte4991a;"SWE:TYPE DCV"
320     OUTPUT @Agte4991a;"SOUR:VOLT:OFFS:STAR "&Start_bias$
330     OUTPUT @Agte4991a;"SOUR:VOLT:OFFS:STOP "&Stop_bias$
340     OUTPUT @Agte4991a;"SOUR:CURR:LIM:OFFS "&Lim_bias$
350     OUTPUT @Agte4991a;"SWE:POIN "&VAL$(Nop)
360     OUTPUT @Agte4991a;"SWE:DIR UP"
370     OUTPUT @Agte4991a;"CALC:AVER:COUN "&VAL$(Swp_count)
380     OUTPUT @Agte4991a;"CALC:AVER ON"
390     !
400     OUTPUT @Agte4991a;"FREQ "&Cw_freq$
410     OUTPUT @Agte4991a;"SOUR:VOLT:MODE FIX"
420     OUTPUT @Agte4991a;"SOUR:VOLT "&Osc_level$
430     !
440     OUTPUT @Agte4991a;"SOUR:VOLT:OFFS:STAT ON"
450     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK1 ON"
460     OUTPUT @Agte4991a;"CALC:BMON ON"
470     !
480     OUTPUT @Agte4991a;"TRIG:SOUR INT"
490     OUTPUT @Agte4991a;"INIT:CONT OFF"
500     OUTPUT @Agte4991a;"ABOR"
510     !
520     CALL Sweep(@Agte4991a)
530     !
540     OUTPUT @Agte4991a;"FORM:DATA REAL,64"
550     !
560     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":DATA? FDATA"
570     ENTER @Agte4991a USING "#,8A";Header$
580     ENTER @Binary;Meas_data(*)
590     ENTER @Agte4991a USING "#,1A";Buff$
600     !
610     OUTPUT @Agte4991a;"CALC:DATA:MON? V"
620     ENTER @Agte4991a USING "#,8A";Header$
630     ENTER @Binary;Mon_bias(*)
640     ENTER @Agte4991a USING "#,1A";Buff$
650     !
660     OUTPUT @Agte4991a;"SWE:STIM3?"
```

```
670     ENTER @Agte4991a USING "#,8A";Header$
680     ENTER @Binary;Swp_prm(*)
690     ENTER @Agte4991a USING "#,1A";Buff$
700     !
710     PRINT "BIAS MONITOR RESULT"
720     PRINT
730     PRINT "DC Bias[V]      Z[ohm]      Mon Bias[V]"
740     PRINT "---------------------------------------"
750     FOR I=1 TO Nop
760       PRINT Swp_prm(I),Meas_data(I),Mon_bias(I)
770     NEXT I
780     !
790     END
800     !
810     SUB Sweep(@Agte4991a)
820       DIM Buff$[9]
830       INTEGER Swp_bool
840       !
850       OUTPUT @Agte4991a;"CALC:AVER?"
860       ENTER @Agte4991a;Swp_bool
870       IF Swp_bool=1 THEN OUTPUT @Agte4991a;"CALC:AVER:CLE"
880       !
890       OUTPUT @Agte4991a;"STAT:OPER:PTR 0"
900       OUTPUT @Agte4991a;"STAT:OPER:NTR 16"
910       OUTPUT @Agte4991a;"STAT:OPER:ENAB 16"
920       OUTPUT @Agte4991a;"*SRE 128"
930       OUTPUT @Agte4991a;"*CLS"
940       OUTPUT @Agte4991a;"*OPC?"
950       ENTER @Agte4991a;Buff$
960       !
970       ON INTR 7 GOTO Swp_end
980       ENABLE INTR 7;2
990       OUTPUT @Agte4991a;"INIT"
1000      DISP "Now Measuring..."
1010  Swp_wait: GOTO Swp_wait
1020  Swp_end: DISP "Sweep Complete"
1030      OFF INTR 7
1040    SUBEND
```

Example program using macro (E4991A VBA)

The dc bias monitor value at the time of the dc bias voltage sweep is read in ASCII transfer format and the results are saved to a specified file. When using a macro, you cannot select a binary transfer format. The program shown in Example 6-4 is saved under the filename bias_mon.bas on the sample programs disk. Below is an explanation of the program's details.

Lines 110 - 190	Substitutes variables for the trace number, dc bias voltage sweep range, number of measurement points, sweep averaging factor, and CW frequency and level value of the signal source.
Line 230	Resets the E4991A.
Lines 250 - 270	Turns on Trace 1 and sets the measurement parameter to impedance. In addition, turns off Trace 2.
Lines 290 - 360	Sets the sweep parameter for the dc bias voltage sweep. Next, sets the sweep range, number of measurement points, sweep direction, and sweep averaging function.
Lines 380 - 400	Sets the CW frequency of the signal source, the mode of the oscillator level, and the level value.
Lines 420 - 440	Turns on the dc bias output and the monitor function. However, when using the monitor function, due to the necessity of setting the marker function in advance, marker 1 is set on.
Lines 460 - 480	Sets the trigger source in the internal trigger and turns off the continuous activation of the trigger system.Then, resets the trigger system and sets the trigger sequence to the idle state.
Lines 500 - 510	Resets the sweep averaging when sweep averaging function is set to on.
Line 530	Starts the sweep and substitutes a variable of "bool" for sweep completion.
Lines 540 - 550	Displays a message of "Sweep Aborted" when sweep is aborted (bool=0) during the measurement.
Line 560	Describes the program routine below this line when sweep is completed without problem (bool=1).
Line 570	Sets the data transfer format to ASCII format.
Lines 590 - 600	Reads out the data trace array.
Lines 610 - 620	Reads out the dc bias level monitor array.
Lines 630 - 640	Reads out the stimulus array.
Lines 660 - 760	Saves the measurement values and the dc bias monitor values to the specified file.
Lines 790	Stops execution of the macro.

Example 6-4 Reading the monitor value

```
10      Sub Main()
20        Dim meas_data As Variant, mon_bias As Variant, swp_prm As
Variant
30         Dim header As String, buff As String, img As String
```

```
40        Dim start_bias As Double, stop_bias As Double, lim_bias As
Double
50         Dim cw_freq As Double, osc_level As Double
60         Dim trc1 As Integer, trc2 As Integer, nop As Integer,
swp_count As Integer
70         Dim i As Integer, swp_bool As Integer, bool As Integer
80         Dim fileNum As Integer
90         Dim file As String
100
110        trc1 = 1
120        trc2 = 2
130        start_bias = 0
140        stop_bias = 40
150        lim_bias = 0.05
160        nop = 41
170        swp_count = 1
180        cw_freq = 100000000#
190        osc_level = 0.1
200
210        ' E4991A settings
220
230        SCPI.Output "SYST:PRES"
240
250        SCPI.Output "DISP:TRAC" & CStr(trc1) & " ON"
260        SCPI.Output "DISP:TRAC" & CStr(trc2) & " OFF"
270        SCPI.Output "CALC" & CStr(trc1) & ":FORM Z"
280
290        SCPI.Output "SWE:TYPE DCV"
300        SCPI.Output "SOUR:VOLT:OFFS:STAR " & CStr(start_bias)
310        SCPI.Output "SOUR:VOLT:OFFS:STOP " & CStr(stop_bias)
320        SCPI.Output "SOUR:CURR:LIM:OFFS " & CStr(lim_bias)
330        SCPI.Output "SWE:POIN " & CStr(nop)
340        SCPI.Output "SWE:DIR UP"
350        SCPI.Output "CALC:AVER:COUN " & CStr(swp_count)
360        SCPI.Output "CALC:AVER ON"
370
380        SCPI.Output "FREQ " & CStr(cw_freq)
390        SCPI.Output "SOUR:VOLT:MODE FIX"
400        SCPI.Output "SOUR:VOLT " & CStr(osc_level)
410
420        SCPI.Output "SOUR:VOLT:OFFS:STAT ON"
430        SCPI.Output "CALC" & CStr(trc1) & ":MARK1 ON"
440        SCPI.Output "CALC:BMON ON"
450
460        SCPI.Output "TRIG:SOUR INT"
470        SCPI.Output "INIT:CONT OFF"
480        SCPI.Output "ABOR"
490
500        swp_bool = SCPI.Query("CALC:AVER?")
510        If swp_bool = 1 Then SCPI.Output "CALC:AVER:CLE"
520
530        bool = SingleMeasure
540        If bool = 0 Then
550          MsgBox ("Sweep Aborted")
560        ElseIf bool = 1 Then
570          SCPI.Output "FORM:DATA ASC"
580
590          SCPI.Output "CALC" & CStr(trc1) & ":DATA? FDATA"
```

```
600         SCPI.Enter meas_data, "#"
610         SCPI.Output "CALC" & CStr(trc1) & ":DATA:MON? V"
620         SCPI.Enter mon_bias, "#"
630         SCPI.Output "SWE:STIM3?"
640         SCPI.Enter swp_prm, "#"
650
660         file = "a:\mon_data.txt"
670         fileNum = FreeFile
680         Open file For Output As #fileNum
690         Print #fileNum, "Bias Monitor Result"
700         Print #fileNum, ""
710        Print #fileNum, "DC Bias[V]     Z[ohm]
Mon. Bias[V]"
720         Print #fileNum,
"------------------------------------------------------------"
730         For i = 1 To nop
740          Print #fileNum, Val(swp_prm(i - 1)), Val(meas_data(i -
1)), Val(mon_bias(i - 1))
750         Next i
760         Close #fileNum
770       End If
780
790       End
800     End Sub
```

7 Measurement Result Processing

This chapter explains how to process measurement results by using the Agilent E4991A's marker function and equivalent circuit analysis function.

Using Marker Function

Markers

Turning On/Off Markers

Markers must first be displayed on a specified trace before the marker function can be used. The E4991A allows you to display up to nine markers (markers 1-8 and a reference marker) on one trace.

Use the following GPIB command to turn on/off Markers 1-8.

- **CALC{1-5}:MARK{1-8}** on page 304

Use the following GPIB command to turn on/off the reference marker (Marker R).

- **CALC{1-5}:MARK:REF** on page 328

The following GPIB command can be used to erase all of the markers on the specified trace.

- **CALC{1-5}:MARK:AOFF** on page 305

Setting the Active Marker

When the marker function is performed with the active marker, it is necessary to set the specified marker to the active marker. If a marker number or the reference marker is not specified in a GPIB command, the command is usually performed on the active marker.

Use the following GPIB command to set one of markers 1-8 as the active marker.

- **CALC{1-5}:MARK{1-8}:ACT** on page 305

Use the following GPIB command to set the reference marker as the active marker.

- **CALC{1-5}:MARK:REF:ACT** on page 329

Selecting Trace for Which Markers Are Displayed

Use the following GPIB command to select whether markers are displayed on a data trace or a memory trace.

- **CALC{1-5}:MARK:ON** on page 327

Displaying Marker List

Use the following GPIB command to display a list of all markers on the screen.

- **CALC{1-5}:MARK:LIST** on page 326

Moving Markers and Reading at Marker Positions

Switching between Continuous Marker and Discontinuous Marker Modes

Use the following GPIB command to select whether a marker can move only to measurement points on a trace or can move to anywhere regardless of measurement points.

- **CALC{1-5}:MARK:DISC** on page 309

Switching Marker Couple Modes

Use the following GPIB command to select whether marker display and movement as well as X-axis value setting are coupled with all of the traces or applied only to individual traces.

- **CALC:MARK:COUP** on page 309

Selecting Unit of Stimulus Value at Marker Position

The following GPIB command can be used to select the unit of a stimulus value at a marker position from measurement parameters, time, and relaxation time.

- **CALC{1-5}:MARK:UNIT** on page 337

Setting and Reading Stimulus Value at Marker Position

Use the following GPIB command to select a marker from 1-8 and move the specified marker to any stimulus value. If this command is executed in the query format, the stimulus value at the marker position is read.

- **CALC{1-5}:MARK{1-8}:X** on page 338

Use the following GPIB command to move the reference marker to any stimulus value. If this command is executed in the query format, the stimulus value at the reference marker position is read.

- **CALC{1-5}:MARK:REF:X**

Reading Measurement Value at Marker Position

The following GPIB command can be used to select a marker from 1-8 and read the measurement value at the specified marker position.

- **CALC{1-5}:MARK{1-8}:Y?** on page 339

The following GPIB command can be used to read the measurement value at the reference marker position.

- **CALC{1-5}:MARK:REF:Y** on page 335

Selecting Measurement Value Format (Complex Trace)

For markers on a scalar trace, a measurement value at the marker position is read based on the measurement parameter selected by the **CALC{1-5}:FORM** command. For markers on a complex trace, a measurement value at the marker position is read in the format selected by the following GPIB command.

- **CALC{4-5}:MARK:FORM** on page 310

Setting Δ Mode

In a marker's Δ mode, the instrument reads the deviation between stimulus values at the specified marker position and at the reference marker as well as the deviation between measurement values at the specified marker position and at the reference marker.

Selecting Reference Marker Mode

The following GPIB command can be used to select either the Δ mode, where the reference marker is set to a stimulus value on the current trace, or the fixed Δ mode, where the reference marker is set to both the current stimulus and the measurement value.

- **CALC{1-5}:MARK:REF:TYPE** on page 333

Setting and Reading Measurement Value at Reference Marker Position (Fixed Δ Mode)

If the fixed Δ mode is selected, the following GPIB command can be used to move the reference marker to the specified measurement value. If this command is executed in the query format, the measurement value at the current reference marker position is read.

- **CALC{1-5}:MARK:REF:Y** on page 335

For a complex trace, move the reference marker to the specified measurement value by first specifying the measurement value with the real and imaginary part of the complex.

Entering Marker Values as E4991A Setting

The stimulus value or measurement value at an active marker position can be used as the E4991A internal setting as follows.

- The stimulus value at an active marker position is entered as the center value of the sweep range.
- The range between the stimulus values at an active marker and a Δ marker is entered as the span value of the sweep range if the Δ marker mode is enabled.
- The stimulus value at an active marker position is entered as the start value of the sweep range.
- The stimulus value at an active marker position is entered as the stop value of the sweep range.
- The measurement value at an active marker position is entered as a reference value on the Y-axis scale.
- For a scalar trace, a measurement value at an active marker position is entered as the offset by which a data trace value is subtracted.

Use the following GPIB command to enter the stimulus value or measurement value at an active marker position as the E4991A setting.

- **CALC{1-5}:MARK:SET** on page 336

Marker Search Function

The marker search function allows you to search for a certain point on a trace and have the active marker move to that point.

Selecting Points to Search for

The marker search function can be used to search for the following points on a trace.

- Maximum value
- Minimum value
- Positive peak value
- Negative peak value
- Target value

Use the following GPIB command to select the point to search for.

- **CALC{1-5}:MARK:FUNC:EXEC** on page 321

Partial Search Function

Normally, a marker search is performed within the entire sweep range. On the other hand, the partial search function can be used to perform marker search within the specified range. Use the following GPIB command to turn on/off the partial search function.

- **CALC{1-5}:MARK:FUNC:DOM** on page 312

If the partial search function is performed, use the following GPIB command to specify the left and right ends of the search range.

- **CALC{1-5}:MARK:FUNC:DOM:STAR** on page 320
- **CALC{1-5}:MARK:FUNC:DOM:STOP** on page 320

Use the following GPIB command to specify the range between an active marker and the reference marker as a search range.

- **CALC{1-5}:MARK:FUNC:DOM:SPAN** on page 319

Defining a Target

The marker's target search function can be used to search for a specified target. Use the following GPIB command to specify a target value.

- **CALC{1-5}:MARK:FUNC:TARG** on page 324

Defining a Peak

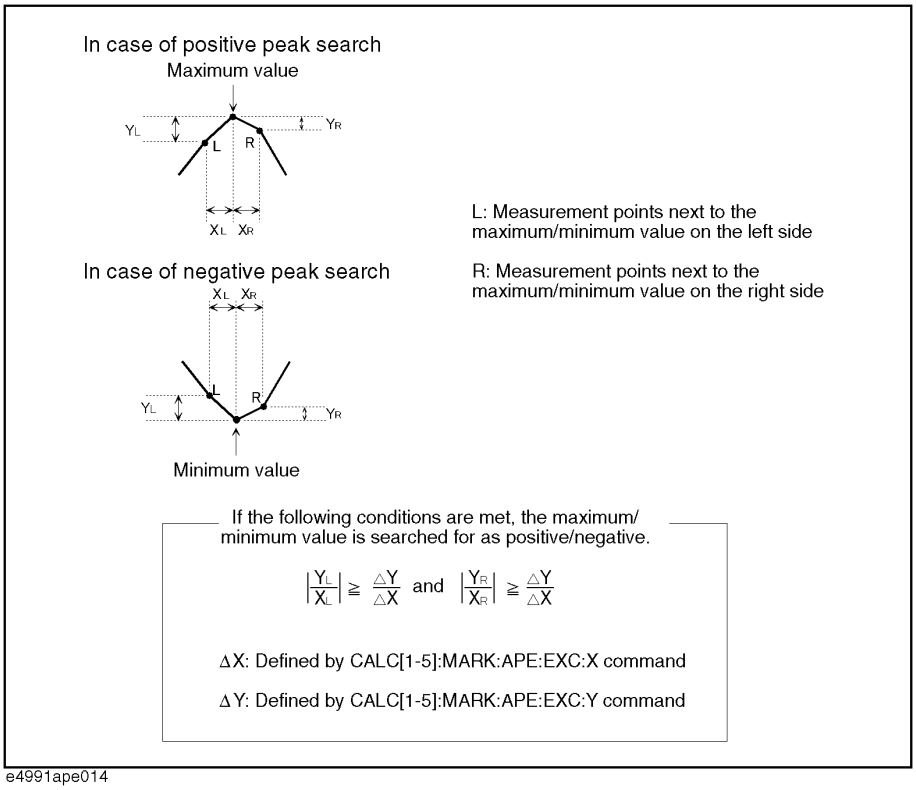
The marker's peak search function searches for the maximum value (positive peak value) or minimum value (negative peak value) that agrees with the definitions shown in Figure 7-1. Use the following GPIB command to define peaks.

- **CALC{1-5}:MARK:APE:EXC:X** on page 307
- **CALC{1-5}:MARK:APE:EXC:Y** on page 308

The following GPIB command can be used to define a peak based on the stimulus value and the measurement value at an active marker position.

- **CALC{1-5}:MARK:APE:SET** on page 306

Figure 7-1 Peak Definition in Marker Search


In case of positive peak search
Maximum value
YL
YR
L
R
XL XR
L: Measurement points next to the maximum/minimum value on the left side
R: Measurement points next to the maximum/minimum value on the right side
In case of negative peak search
XL XR
L
R
YL
YR
Minimum value
If the following conditions are met, the maximum/ minimum value is searched for as positive/negative.
|YL/XL| ≧ ΔY/ΔX and |YR/XR| ≧ ΔY/ΔX
ΔX: Defined by CALC[1-5]:MARK:APE:EXC:X command
ΔY: Defined by CALC[1-5]:MARK:APE:EXC:Y command

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Performing Marker Search

The following GPIB command can be used to perform marker search only once for a specified target on a specified trace. When the specified target is found, the active marker moves to that point.

- **CALC{1-5}:MARK:FUNC:EXEC** on page 321

When the **CALC{1-5}:MARK:FUNC** command is used to select a target, the positive peak, or the negative peak to search for, the following GPIB command can be used to perform marker search only once for a target or a peak on the right or left side of the current active marker.

- **CALC{1-5}:MARK:FUNC:EXEC:RIGH** on page 323
- **CALC{1-5}:MARK:FUNC:EXEC:LEFT** on page 322

During positive/negative peak search, the following GPIB command can be used to search for the next highest peak.

- **CALC{1-5}:MARK:FUNC:EXEC:NEXT** on page 322

Repeating Marker Search (Tracking Function)

To perform marker search automatically for each sweep, use the following GPIB command to turn on/off the tracking function.

- **CALC{1-5}:MARK:FUNC:TRAC** command on page 325

Once tracking is enabled, the marker search function is performed for a target on the trace specified with the following GPIB command.

- **CALC{1-5}:MARK:FUNC** on page 311

Reading Marker Search Results by Using the Status Report System

You can read the marker search results for a specified trace by using the status report system. See Table B-7, “Status Bit Definition of Questionable Status Search Event Register,” on page 567 for more information.

Limit Test Function

The marker's limit test function can be used to determine whether the measurement value at the marker position specified as the test marker falls within the range of the test limit.

Setting Test Marker

Before performing limit tests, the following GPIB command must be used to select one of markers 1-8 as the test marker.

- **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM** on page 313

The following GPIB command can be used to select the reference marker as the test marker.

- **CALC{1-5}:MARK:REF:FUNC:DOM:LIM** on page 329

Setting Test Limits

Before performing a limit test, the upper and lower limits of the test must be specified.

If one of the markers 1-8 is selected as the test marker, use the following GPIB commands to set the upper and lower limits of the limit test.

- **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:UP** on page 318
- **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:LOW** on page 316

If the reference marker is selected as the test marker, use the following GPIB commands to set the upper and lower limits of the limit test.

- **CALC{1-5}:MARK:REF:FUNC:DOM:LIM:UP** on page 332
- **CALC{1-5}:MARK:REF:FUNC:DOM:LIM:LOW** on page 330

NOTE When the limit test function is performed on a complex trace, the real part of the measurement data on the specified marker is compared with the test limits.

Turning On/Off Limit Test Function

Use the following GPIB command to turn on/off the limit test function.

- **CALC{1-5}:MARK:FUNC:DOM:LIM:ALL** on page 314

Reading Limit Test Results

Limit test results can be read in two ways: Reading the test result of a specified test marker or reading the overall evaluation results of all test markers (that is, the test results for all of the test markers are logically ANDed).

Use the following GPIB command to read the test result of a specified test marker (1-8).

- **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:RES?** on page 317

If the reference marker is selected as a test marker, the following GPIB command can be used to read a limit test result.

- **CALC{1-5}:MARK:REF:FUNC:DOM:LIM:RES?** on page 331

The following GPIB command can be used to read the overall evaluation results of the limit tests of all test markers (that is, the test results for all of the test markers are logically ANDed).

- **CALC{1-5}:MARK:FUNC:DOM:LIM:ALL:RES?** on page 315

Reading Limit Test Results by Using Status Report System

You can read the limit test results by using the status report system. See Table B-6, “Status Bit Definition of Questionable Status Limit Event Register,” on page 566 for more information.

Combining Limit Test and Δ Mode

Limit tests can also be performed on the deviation between measurement values at the reference marker and those at any other marker. To do this, select the reference marker as a test marker and use the following GPIB command to set the mode to Δ or fixed Δ.

- **CALC{1-5}:MARK:REF:TYPE** on page 333

Displaying Test Conditions and Test Results for Each Marker

The following GPIB command can de used to display test conditions of a limit test and test results for each marker.

- **DISP:TEXT{1-3}:SET** on page 356

Statistical Analysis Function

The E4991A has a function to analyze the statistical information of a specified trace, including averages, standard deviation, and the difference between maximum and minimum values. Use the following GPIB command to turn on/off the statistical analysis function.

- **CALC{1-5}:MST** on page 343

NOTE The statistical analysis function can only be used when the marker function is enabled. If a marker search range is specified, the statistical analysis is performed within that range.

Use the following GPIB command to read analysis results.

- **CALC{1-5}:MST:DATA?** on page 344

Example Programs for Marker Search Function

Example programs for the marker search function are shown below. After a sweep is performed, the positive and negative peaks are searched within the range of 100 MHz - 1 GHz by the marker function, a marker is placed at each location, and the marked values are read and displayed.

Example program using HTBasic

Example 7-1 shows an example program for the marker search function. This program is saved under the filename mkr_sear.htb on the sample programs disk. Below is an explanation of the program's details.

Line 60	Sets the GPIB address.
Lines 80 - 150	Substitutes variables for the trace number, marker number, partial search range, and defined peak value.
Line 190	Resets the E4991A.
Lines 200 - 230	Displays Trace 1 and sets the measurement parameter. In addition, turns off Trace 2.
Line 250	Sets the sweep parameter (sweep type).
Lines 270 - 290	Sets the trigger source to the internal trigger and turns off the continuous activation of the trigger system. Then, it resets the trigger system and sets the trigger sequence to the idle state.
Line 310	Calls the sub-program for executing a sweep.
Line 330	Runs the auto-scale adjustment for Trace.
Lines 350 - 380	Turns on Markers 1 and 2 and sets the instrument to continuous marker mode.
Lines 400 - 450	Turns on the partial search function and sets the left and right boundaries of the partial search range.
Lines 470 -480	Sets the ΔX value and ΔY value to define the peak.
Lines 520 - 540	After setting marker 1 as the active marker, searches for the positive peak and moves the marker to it.
Lines 550 - 630	Reads the marker search results by using a function sub-program (FNPeak_found). When a positive peak is found, reads the stimulus value and measurement value at the active marker (positive peak) position. Or, when a positive peak is not found, displays "Peak Not Found".
Lines 650 - 670	After setting marker 2 as the active marker, searches for the positive peak and moves the marker to it.
Lines 680 - 760	Reads the marker search results by using a function sub-program (FNPeak_found). When a negative peak is found, reads the stimulus value and measurement value at the active marker (negative peak) position. Or, when a negative peak is not found, displays "Peak Not Found".
Lines 800 - 1030	Refer to "Example Programs for Detecting Measurement End" on page 114 for an explanation of the sub-program.

Lines 1080 - 1120 In the function sub-program (FNPeak_found), reads the marker search results at the specified trace by using questionable status marker condition resistor. When marker search failure occurs, a bit on the specified trace is set to 1and the function sub-program returns the value of 1.

Example 7-1 Searching for a peak by using a marker (HTBasic)

```
10      INTEGER Trc1,Trc2,Mkr1,Mkr2
20      REAL Sear_start,Search_stop,Delta_x,Delta_y
30      REAL P_peak_x,P_peak_y,N_peak_x,N_peak_y
40      !
50      CLEAR SCREEN
60      ASSIGN @Agte4991a TO 717
70      !
80      Trc1=1
90      Trc2=2
100     Mkr1=1
110     Mkr2=2
120     Sear_start=1.00E+8
130     Sear_stop=1.E+9
140     Delta_x=1.0E+6
150     Delta_y=.1
160     !
170     ! E4991A settings
180     !
190     OUTPUT @Agte4991a;"SYST:PRES"
200     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&" ON"
210     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc2)&" OFF"
220     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":FORM Z"
230     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&":SEL"
240     !
250     OUTPUT @Agte4991a;"SWE:TYPE LOG"
260     !
270     OUTPUT @Agte4991a;"TRIG:SOUR INT"
280     OUTPUT @Agte4991a;"INIT:CONT OFF"
290     OUTPUT @Agte4991a;"ABOR"
300     !
310     CALL Sweep(@Agte4991a)
320     !
330     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&":Y:AUTO"
340     !
350     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK:AOFF"
360     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr1)&" ON"
370     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr2)&" ON"
380     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK:DISC OFF"
390     !
400     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK:FUNC:DOM ON"
410     OUTPUT
@Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr1)&":ACT"
420     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr1)&":X
"&VAL$(Sear_start)
430     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK:FUNC:DOM:STAR"
440     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr1)&":X
"&VAL$(Sear_stop)
450     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK:FUNC:DOM:STOP"
460     !
470     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK:APE:EXC:X
```

```
"&VAL$(Delta_x)
480     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK:APE:EXC:Y
"&VAL$(Delta_y)
490     !
500     PRINT "Search Range: "&VAL$(Sear_start/1.E+6)&"MHz -
"&VAL$(Sear_stop/1.E+6)&"MHz"
510     !
520     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr1)&":X
"&VAL$(Sear_start)
530     OUTPUT
@Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr1)&":ACT"
540     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK:FUNC:EXEC PPE"
550     IF FNPeak_found(@Agte4991a,Trc1)=0 THEN
560       OUTPUT
@Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr1)&":X?"
570       ENTER @Agte4991a;P_peak_x
580       OUTPUT
@Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr1)&":Y?"
590       ENTER @Agte4991a;P_peak_y
600       PRINT "Positive Peak: ";P_peak_y;"[ohm]
@";P_peak_x/1.E+6;"MHz"
610     ELSE
620       PRINT "Positive Peak: Not Found"
630     END IF
640     !
650     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr2)&":X
"&VAL$(Sear_start)
660     OUTPUT
@Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr2)&":ACT"
670     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK:FUNC:EXEC NPE"
680     IF FNPeak_found(@Agte4991a,Trc1)=0 THEN
690       OUTPUT
@Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr2)&":X?"
700       ENTER @Agte4991a;N_peak_x
710       OUTPUT
@Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr2)&":Y?"
720       ENTER @Agte4991a;N_peak_y
730       PRINT "Negative Peak: ";N_peak_y;"[ohm]
@";N_peak_x/1.E+6;"MHz"
740     ELSE
750       PRINT "Negative Peak: Not Found"
760     END IF
770     !
780     END
790     !
800     SUB Sweep(@Agte4991a)
810       DIM Buff$[9]
820       INTEGER Swp_bool
830       !
840       OUTPUT @Agte4991a;"CALC:AVER?"
850       ENTER @Agte4991a;Swp_bool
860       IF Swp_bool=1 THEN OUTPUT @Agte4991a;"CALC:AVER:CLE"
870       !
880       OUTPUT @Agte4991a;"STAT:OPER:PTR 0"
890       OUTPUT @Agte4991a;"STAT:OPER:NTR 16"
900       OUTPUT @Agte4991a;"STAT:OPER:ENAB 16"
910       OUTPUT @Agte4991a;"*SRE 128"
920       OUTPUT @Agte4991a;"*CLS"
```

```
930       OUTPUT @Agte4991a;"*OPC?"
940       ENTER @Agte4991a;Buff$
950       !
960       ON INTR 7 GOTO Swp_end
970       ENABLE INTR 7;2
980       OUTPUT @Agte4991a;"INIT"
990       DISP "Now Measuring..."
1000 Swp_wait: GOTO Swp_wait
1010 Swp_end: DISP "Sweep Complete"
1020      OFF INTR 7
1030    SUBEND
1040    !
1050    DEF FNPeak_found(@Agte4991a,INTEGER Trc)
1060      INTEGER Sear_cond,Peak_found
1070      !
1080      OUTPUT @Agte4991a;"STAT:QUES:SEAR:COND?"
1090      ENTER @Agte4991a;Sear_cond
1100      Peak_found=BIT(Sear_cond,Trc)
1110      RETURN Peak_found
1120    FNEND
```

Example program using macro (E4991A VBA)

Example 7-2 shows an example program for the marker search function. This program is saved under the filename mkr_sear.bas on the sample programs disk. Below is an explanation of the program's details.

Lines 110 - 180	Substitutes variables for the trace number, marker number, partial search range, and defined peak value.
Line 220	Resets the E4991A.
Lines 240 - 270	Displays Trace 1 and sets the measurement parameter. In addition, turns off Trace 2.
Line 290	Sets the sweep parameter (sweep type).
Lines 310 - 330	Sets the trigger source to the internal trigger and turns off the continuous activation of the trigger system. Then, it resets the trigger system and sets the trigger sequence to the idle state.
Lines 350 - 360	Resets sweep averaging when sweep averaging function is set to on.
Line 380	Starts the sweep and substitutes a variable of "bool" for sweep completion.
Lines 390 - 400	Displays a message of "Sweep Aborted" when sweep is aborted (bool=0) during the measurement.
Line 410	Describes the program routine below this line when sweep is completed without problem (bool=1).
Line 430	Executes an auto-scale adjustment on the specified trace.
Lines 450 - 480	Sets Marker 1 and Marker 2 to on and sets the instrument to continuous marker mode.
Lines 500 - 550	Turns on the partial search function and moves the active marker to a specified position on the X-axis. Next, sets the left and right boundaries of the partial search range.
Lines 570 - 580	Sets the ΔX and ΔY values to define the peak.
Lines 620 - 640	Sets Marker 1 as the active marker. Next, executes a positive peak search and moves the active marker to the positive peak position.
Line 650	Reads out the result of the positive peak search using the function program "peak_not_found".
Lines 660 - 670	Displays a message of "Sweep Aborted" when a positive peak is not found.
Lines 680 - 740	Reads and displays the stimulus value and measurement value at the active marker (positive peak) position when a positive peak is found.
Lines 760 - 780	Sets Marker 2 as the active marker. Next, executes a negative peak search and moves the active marker to the negative peak position.
Line 790	Reads out the result of the negative peak search using the function program "peak_not_found".
Lines 800 - 810	Displays the message of "Sweep Aborted" when a negative peak is not found.
Lines 820 - 880	Reads and displays the stimulus value and measurement value at the

active marker (negative peak) position when a negative peak is found.

Line 910 — Stops the execution of the macro.

Lines 950 - 1510 — In the function program (peak_not_found), reads the marker search results at the specified trace by using the questionable status marker condition resistor. When marker search failure occurs, the bit on the specified trace is set to 1and the function program returns a value of 1.

Example 7-2 **Searching for a peak by using a marker (macro)**

```
10      Sub Main()
20       Dim trc1 As Integer, trc2 As Integer, mkr1 As Integer, mkr2
As Integer
30        Dim sear_start As Double, sear_stop As Double
40        Dim delta_x As Double, delta_y As Double
50        Dim p_peak_x As Double, p_peak_y As Double
60        Dim n_peak_x As Double, n_peak_y As Double
70        Dim peak_found As Integer
80        Dim swp_bool As Integer, beak_query As Integer, bool As
Integer
90        Dim msg As String
100
110       trc1 = 1
120       trc2 = 2
130       mkr1 = 1
140       mkr2 = 2
150       sear_start = 100000000#
160       sear_stop = 1000000000#
170       delta_x = 1000000#
180       delta_y = 0.1
190
200       ' E4991A settings
210
220       SCPI.Output "SYST:PRES"
230
240       SCPI.Output "DISP:TRAC" & CStr(trc1) & " ON"
250       SCPI.Output "DISP:TRAC" & CStr(trc2) & " OFF"
260       SCPI.Output "CALC" & CStr(trc1) & ":FORM Z"
270       SCPI.Output "DISP:TRAC" & CStr(trc1) & ":SEL"
280
290       SCPI.Output "SWE:TYPE LOG"
300
310       SCPI.Output "TRIG:SOUR INT"
320       SCPI.Output "INIT:CONT OFF"
330       SCPI.Output "ABOR"
340
350       swp_bool = SCPI.Query("CALC:AVER?")
360       If swp_bool = 1 Then SCPI.Output "CALC:AVER:CLE"
370
380       bool = SingleMeasure
390       If bool = 0 Then
400         MsgBox ("Sweep Aborted")
410       ElseIf bool = 1 Then
420
430         SCPI.Output "DISP:TRAC" & CStr(trc1) & ":Y:AUTO"
440
450         SCPI.Output "CALC" & CStr(trc1) & ":MARK:AOFF"
460        SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr1) &
```

```
" ON"
470         SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr2) &
" ON"
480          SCPI.Output "CALC" & CStr(trc1) & ":MARK:DISC OFF"
490
500          SCPI.Output "CALC" & CStr(trc1) & ":MARK:FUNC:DOM ON"
510         SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr) &
":ACT"
520         SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr) &
":X " & CStr(sear_start)
530          SCPI.Output "CALC" & CStr(trc1) & ":MARK:FUNC:DOM:STAR"
540         SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr) &
":X " & CStr(sear_stop)
550          SCPI.Output "CALC" & CStr(trc1) & ":MARK:FUNC:DOM:STOP"
560
570          SCPI.Output "CALC" & CStr(trc1) & ":MARK:APE:EXC:X " &
CStr(delta_x)
580          SCPI.Output "CALC" & CStr(trc1) & ":MARK:APE:EXC:Y " &
CStr(delta_y)
590
600          msg = "Search range: " & CStr(sear_start / 1000000#) &
"MHz - " & CStr(sear_stop / 1000000#) & "MHz"
610
620         SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr1) &
":X " & CStr(sear_start)
630         SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr1) &
":ACT"
640          SCPI.Output "CALC" & CStr(trc1) & ":MARK:FUNC:EXEC PPE"
650          peak_query = peak_not_found(trc1)
660          If peak_query = 1 Then
670            MsgBox ("Positive Peak Not Found")
680          ElseIf peak_query = 0 Then
690           SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr1)
& ":X?"
700            SCPI.Enter p_peak_x
710           SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr1)
& ":Y?"
720            SCPI.Enter p_peak_y
730            MsgBox (msg & vbCrLf & "Positive Peak: " &
CStr(p_peak_y) & "[ohm]  @" & CStr(p_peak_x / 1000000#) & "MHz")
740          End If
750
760         SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr2) &
":X " & CStr(sear_start)
770         SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr2) &
":ACT"
780          SCPI.Output "CALC" & CStr(trc1) & ":MARK:FUNC:EXEC NPE"
790          peak_query = peak_not_found(trc1)
800          If peak_query = 1 Then
810            MsgBox ("Negative Peak Not Found")
820          ElseIf peak_query = 0 Then
830           SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr2)
& ":X?"
840            SCPI.Enter n_peak_x
850           SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr2)
& ":Y?"
860            SCPI.Enter n_peak_y
870            MsgBox (msg & vbCrLf & "Negative Peak: " &
```

```
CStr(n_peak_y) & "[ohm]  @" & CStr(n_peak_x / 1000000#) & "MHz")
880         End If
890       End If
900
910       End
920
930     End Sub
940
950     Private Function peak_not_found(trc As Integer)
960       Dim reg As String
970       Dim div As Integer, Mo As Integer
980
990       SCPI.Output "STAT:QUES:SEAR:COND?"
1000      SCPI.Enter reg
1010
1020      div = Val(reg) \ 32
1030      Mo = Val(reg) Mod 32
1040      If div = 1 Then
1050        trc5 = 1
1060      ElseIf div = 0 Then
1070        trc5 = 0
1080      End If
1090      div = Mo \ 16
1100      Mo = Mo Mod 16
1110      If div = 1 Then
1120        trc4 = 1
1130      ElseIf div = 0 Then
1140        trc4 = 0
1150      End If
1160      div = Mo \ 8
1170      Mo = Mo Mod 8
1180      If div = 1 Then
1190        trc3 = 1
1200      ElseIf div = 0 Then
1210        trc3 = 0
1220      End If
1230      div = Mo \ 4
1240      Mo = Mo Mod 4
1250      If div = 1 Then
1260        trc2 = 1
1270      ElseIf div = 0 Then
1280        trc2 = 0
1290      End If
1300      div = Mo \ 2
1310      Mo = Mo Mod 2
1320      If div = 1 Then
1330        trc1 = 1
1340      ElseIf div = 0 Then
1350        trc1 = 0
1360      End If
1370
1380      Select Case trc
1390      Case 1
1400        peak_not_found = trc1
1410      Case 2
1420        peak_not_found = trc2
1430      Case 3
1440        peak_not_found = trc3
```

```
1450      Case 4
1460        peak_not_found = trc4
1470      Case 5
1480        peak_not_found = trc5
1490      End Select
1500
1510    End Function
```

Example Programs for Marker Limit Test Function

Below are example programs for the limit test function. After sweeping, this executes a limit test at the specified test marker position and displays the PASS/FAIL test results.

Example program using HTBasic

Example 7-3 shows an example program for the marker limit test. This program is saved under the filename lim_test.htb on the sample programs disk. Below is an explanation of the program's details.

Line 70	Sets the GPIB address.
Lines 90 - 100	Substitutes a variable for the trace number.
Line 120 - 400	Substitutes variables for the stimulus value and the upper and lower values of the test limit used in the limit test.
Line 440	Resets the E4991A.
Lines 460 - 480	Turns on Trace 1 and sets the measurement parameter and display format. Turns off Trace 2.
Line 500	Sets the sweep parameter.
Lines 520 - 560	Sets the reference marker for the test marker and sets the stimulus value and the upper and lower limits for the test limit.
Line 580 - 640	Sets Markers 1-8 for the test marker and sets the stimulus value and the upper and lower limits for the test limit.
Line 660	Turns on the marker limit test function.
Lines 680 - 700	Sets the trigger source to the internal trigger and turns off the continuous activation of the trigger system. Then, it resets the trigger system and sets the trigger sequence to the idle state.
Line 730	Calls the sub-program for executing sweep.
Line 750	Executes auto-scale adjustment for the trace.
Lines 770 - 800	Reads the measured value of the reference marker and the result of the limit test.
Lines 820 - 870	Reads the measured values of the positions of Markers 1 - 8 and the limit test result.
Lines 890 - 900	Reads the overall decision results of the limit tests at all of the test markers.
Lines 920 - 1010	Displays the test conditions and results of the limit test.
Lines 1050 - 1280	Refer to "Example Programs for Detecting Measurement End" on page 114 for an explanation of the sub-program.

Example 7-3 **Execution of the limit test using a marker (HTBasic)**

```
10      DIM Mkr1_stim(8),Mkr1_upp(8),Mkr1_low(8),Mkr1_meas(8)
20      DIM Ref_judge$[4],Mkr1_judge$(8)[4],All_judge$[4]
30      REAL Ref_stim,Ref_upp,Ref_low,Ref_meas
40      INTEGER Trc1,Trc2,Mkr
50      !
60      CLEAR SCREEN
70      ASSIGN @Agte4991a TO 717
80      !
90      Trc1=1
100     Trc2=2
110     !
120     Ref_stim=1.E+6
130     Mkr1_stim(1)=5.0E+6
140     Mkr1_stim(2)=1.0E+7
150     Mkr1_stim(3)=5.0E+7
160     Mkr1_stim(4)=1.0E+8
170     Mkr1_stim(5)=5.0E+8
180     Mkr1_stim(6)=1.0E+9
190     Mkr1_stim(7)=2.0E+9
200     Mkr1_stim(8)=3.0E+9
210     !
220     Ref_upp=80
230     Mkr1_upp(1)=80
240     Mkr1_upp(2)=70
250     Mkr1_upp(3)=70
260     Mkr1_upp(4)=70
270     Mkr1_upp(5)=70
280     Mkr1_upp(6)=80
290     Mkr1_upp(7)=80
300     Mkr1_upp(8)=90
310     !
320     Ref_low=20
330     Mkr1_low(1)=20
340     Mkr1_low(2)=30
350     Mkr1_low(3)=30
360     Mkr1_low(4)=30
370     Mkr1_low(5)=30
380     Mkr1_low(6)=20
390     Mkr1_low(7)=20
400     Mkr1_low(8)=10
410     !
420     ! E4991A settings
430     !
440     OUTPUT @Agte4991a;"SYST:PRES"
450     !
460     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&" ON"
470     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc2)&" OFF"
480     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":FORM Z"
490     !
500     OUTPUT @Agte4991a;"SWE:TYPE LOG"
510     !
520     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK:REF ON"
530     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK:REF:FUNC:DOM:LIM
ON"
540     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK:REF:X
```

```
"&VAL$(Ref_stim)
550     OUTPUT
@Agte4991a;"CALC"&VAL$(Trc1)&":MARK:REF:FUNC:DOM:LIM:UP
"&VAL$(Ref_upp)
560     OUTPUT
@Agte4991a;"CALC"&VAL$(Trc1)&":MARK:REF:FUNC:DOM:LIM:LOW
"&VAL$(Ref_low)
570     !
580     FOR Mkr=1 TO 8
590       OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr)&" ON"
600       OUTPUT
@Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr)&":FUNC:DOM:LIM ON"
610       OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr)&":X
"&VAL$(Mkr1_stim(Mkr))
620       OUTPUT
@Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr)&":FUNC:DOM:LIM:UP
"&VAL$(Mkr1_upp(Mkr))
630       OUTPUT
@Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr)&":FUNC:DOM:LIM:LOW
"&VAL$(Mkr1_low(Mkr))
640     NEXT Mkr
650     !
660     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK:FUNC:DOM:LIM:ALL
ON"
670     !
680     OUTPUT @Agte4991a;"TRIG:SOUR INT"
690     OUTPUT @Agte4991a;"INIT:CONT OFF"
700     OUTPUT @Agte4991a;"ABOR"
710     !
720     !
730     CALL Sweep(@Agte4991a)
740     !
750     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&":Y:AUTO"
760     !
770     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK:REF:Y?"
780     ENTER @Agte4991a;Ref_meas
790     OUTPUT
@Agte4991a;"CALC"&VAL$(Trc1)&":MARK:REF:FUNC:DOM:LIM:RES?"
800     ENTER @Agte4991a;Ref_judge$
810     !
820     FOR Mkr=1 TO 8
830       OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr)&":Y?"
840        ENTER @Agte4991a;Mkr1_meas(Mkr)
850        OUTPUT
@Agte4991a;"CALC"&VAL$(Trc1)&":MARK"&VAL$(Mkr)&":FUNC:DOM:LIM:RES?"
860        ENTER @Agte4991a;Mkr1_judge$(Mkr)
870     NEXT Mkr
880     !
890     OUTPUT
@Agte4991a;"CALC"&VAL$(Trc1)&":MARK:FUNC:DOM:LIM:ALL:RES?"
900     ENTER @Agte4991a;All_judge$
910     !
920     PRINT "Marker Limit Test Results"
930     PRINT
940    PRINT "Mkr     freq.     lower       actual       upper
judge    "
950     PRINT
"-----------------------------------------------------------------
```

```
_"
960     PRINT " R",Ref_stim,Ref_low,Ref_meas,Ref_upp,Ref_judge$
970     FOR Mkr=1 TO 8
980     PRINT
Mkr,Mkr1_stim(Mkr),Mkr1_low(Mkr),Mkr1_meas(Mkr),Mkr1_upp(Mkr),Mkr1_
judge$(Mkr)
990     NEXT Mkr
1000    PRINT
"-----------------------------------------------------------------"
1010    PRINT "total
"&All_judge$
1020    !
1030    END
1040    !
1050    SUB Sweep(@Agte4991a)
1060      DIM Buff$[9]
1070      INTEGER Swp_bool
1080      !
1090      OUTPUT @Agte4991a;"CALC:AVER?"
1100      ENTER @Agte4991a;Swp_bool
1110      IF Swp_bool=1 THEN OUTPUT @Agte4991a;"CALC:AVER:CLE"
1120      !
1130      OUTPUT @Agte4991a;"STAT:OPER:PTR 0"
1140      OUTPUT @Agte4991a;"STAT:OPER:NTR 16"
1150      OUTPUT @Agte4991a;"STAT:OPER:ENAB 16"
1160      OUTPUT @Agte4991a;"*SRE 128"
1170      OUTPUT @Agte4991a;"*CLS"
1180      OUTPUT @Agte4991a;"*OPC?"
1190      ENTER @Agte4991a;Buff$
1200      !
1210      ON INTR 7 GOTO Swp_end
1220      ENABLE INTR 7;2
1230      OUTPUT @Agte4991a;"INIT"
1240      DISP "Now Measuring..."
1250 Swp_wait: GOTO Swp_wait
1260 Swp_end: DISP "Sweep Complete"
1270      OFF INTR 7
1280    SUBEND
```

Example program using macro (E4991A VBA)

Example 7-4 shows an example program for the marker limit test. This program is saved under the filename lim_test.bas on the sample programs disk. Below is an explanation of the program's details.

Lines 100 - 110	Substitutes a variable for the trace number.
Line 130 - 410	Substitutes variables for the stimulus value of the test marker and the upper and lower values of the test limit.
Line 450	Resets the E4991A.
Lines 470 - 490	Turns on Trace 1 and sets the measurement parameter and display format. Turns off Trace 2.
Line 510	Sets the sweep parameter.
Lines 530 - 570	Sets the reference marker to the test marker and sets the stimulus value for the test marker and the upper and lower values for the test limit.
Line 590 - 650	Sets Markers 1-8 to the test marker and sets the stimulus value for the test marker and the upper and lower values for the test limit.
Line 670	Turns on the marker limit test function.
Lines 690 - 710	Sets the trigger source to the internal trigger and turns off the continuous activation of the trigger system. Then, it resets the trigger system and sets the trigger sequence to the idle state.
Lines 730 - 740	Resets sweep averaging when sweep averaging function is set to on.
Line 760	Starts the sweep and substitutes a variable of "bool" for sweep completion.
Lines 770 - 780	Displays a message of "Sweep Aborted" when sweep is aborted (bool=0) during the measurement.
Line 790	Describes the program routine below this line when sweep is completed without problem (bool=1).
Line 800	Executes auto-scale adjustment for the specified trace.
Lines 820 - 850	Reads the measurement value at the reference marker and the results of the limit test.
Lines 870 - 920	Reads the measurement values at the Markers 1-8 and the results of the limit test.
Line 940	Reads the results of the limit tests at all of the test markers.
Lines 960 - 1110	Saves the limit test results to a specified file (a:\lim_res.txt) and displays the results of the limit test.
Line 1130	Stops the execution of the macro.

Example 7-4 **Execution of the limit test using a marker (macro)**

```
10      Sub Main()
20        Dim mkr1_stim(8) As Double, mkr1_upp(8) As Double,
mkr1_low(8) As Double
30        Dim mkr1_meas(8) As Double
40        Dim ref_stim As Double, ref_upp As Double, ref_low As
Double, ref_meas As Double
50        Dim ref_judge As String, mkr1_judge(8) As String,
all_judge As String
60        Dim trc1 As Integer, trc2 As Integer, mkr As Integer
70        Dim swp_bool As Integer, bool As Integer
80        Dim file As String
90
100       trc1 = 1
110       trc2 = 2
120
130       ref_stim = 1000000#
140       mkr1_stim(1) = 5000000#
150       mkr1_stim(2) = 10000000#
160       mkr1_stim(3) = 50000000#
170       mkr1_stim(4) = 100000000#
180       mkr1_stim(5) = 500000000#
190       mkr1_stim(6) = 1000000000#
200       mkr1_stim(7) = 2000000000#
210       mkr1_stim(8) = 3000000000#
220
230       ref_upp = 80
240       mkr1_upp(1) = 80
250       mkr1_upp(2) = 70
260       mkr1_upp(3) = 70
270       mkr1_upp(4) = 70
280       mkr1_upp(5) = 70
290       mkr1_upp(6) = 80
300       mkr1_upp(7) = 80
310       mkr1_upp(8) = 80
320
330       ref_low = 20
340       mkr1_low(1) = 20
350       mkr1_low(2) = 30
360       mkr1_low(3) = 30
370       mkr1_low(4) = 30
380       mkr1_low(5) = 30
390       mkr1_low(6) = 20
400       mkr1_low(7) = 20
410       mkr1_low(8) = 20
420
430       ' E4991A settings
440
450       SCPI.Output "SYST:PRES"
460       '
470       SCPI.Output "DISP:TRAC" & CStr(trc1) & " ON"
480       SCPI.Output "DISP:TRAC" & CStr(trc2) & " OFF"
490       SCPI.Output "CALC" & CStr(trc1) & ":FORM Z"
500
510       SCPI.Output "SWE:TYPE LOG"
520
```

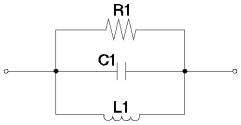
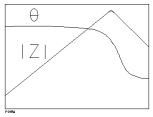
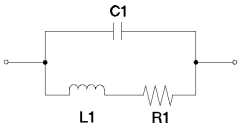
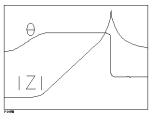
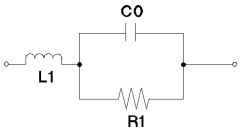
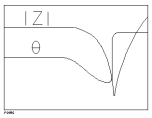
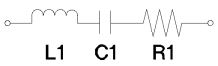
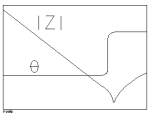
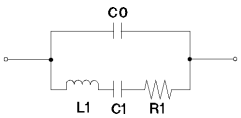
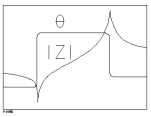
```
530       SCPI.Output "CALC" & CStr(trc1) & ":MARK:REF ON"
540       SCPI.Output "CALC" & CStr(trc1) & ":MARK:REF:FUNC:DOM:LIM
ON"
550       SCPI.Output "CALC" & CStr(trc1) & ":MARK:REF:X " &
CStr(ref_stim)
560       SCPI.Output "CALC" & CStr(trc1) &
":MARK:REF:FUNC:DOM:LIM:UP " & CStr(ref_upp)
570       SCPI.Output "CALC" & CStr(trc1) &
":MARK:REF:FUNC:DOM:LIM:LOW " & CStr(ref_low)
580
590       For mkr = 1 To 8
600         SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr) &
" ON"
610         SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr) &
":FUNC:DOM:LIM ON"
620         SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr) &
":X " & CStr(mkr1_stim(mkr))
630         SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr) &
":FUNC:DOM:LIM:UP " & CStr(mkr1_upp(mkr))
640         SCPI.Output "CALC" & CStr(trc1) & ":MARK" & CStr(mkr) &
":FUNC:DOM:LIM:LOW " & CStr(mkr1_low(mkr))
650       Next mkr
660
670       SCPI.Output "CALC" & CStr(trc1) & ":MARK:FUNC:DOM:LIM:ALL
ON"
680
690       SCPI.Output "TRIG:SOUR INT"
700       SCPI.Output "INIT:CONT OFF"
710       SCPI.Output "ABOR"
720
730       swp_bool = SCPI.Query("CALC:AVER?")
740       If swp_bool = 1 Then SCPI.Output "CALC:AVER:CLE"
750
760       bool = SingleMeasure
770       If bool = 0 Then
780         MsgBox ("Sweep Aborted")
790       ElseIf bool = 1 Then
800         SCPI.Output "DISP:TRAC" & CStr(trc1) & ":Y:AUTO"
810
820         SCPI.Output ("CALC" & CStr(trc1) & ":MARK:REF:Y?")
830         SCPI.Enter ref_meas
840         SCPI.Output ("CALC" & CStr(trc1) &
":MARK:REF:FUNC:DOM:LIM:RES?")
850         SCPI.Enter ref_judge
860
870         For mkr = 1 To 8
880          SCPI.Output ("CALC" & CStr(trc1) & ":MARK" & CStr(mkr)
& ":Y?")
890           SCPI.Enter mkr1_meas(mkr)
900          SCPI.Output ("CALC" & CStr(trc1) & ":MARK" & CStr(mkr)
& ":FUNC:DOM:LIM:RES?")
910           SCPI.Enter mkr1_judge(mkr)
920         Next mkr
930
940         all_judge = SCPI.Query("CALC" & CStr(trc1) &
":MARK:FUNC:DOM:LIM:ALL:RES?")
950
960         file = "a:\lim_res.txt"
```

```
970         Open file For Output As #1
980         Print #1, "Marker Limit Test Results"
990         Print #1, ""
1000      Print #1, " Mkr      freq.[MHz]     lower       actual
upper        judge"
1010        Print #1,
"-------------------------------------------------------------------
------"
1020        Print #1, "R", ref_stim / 1000000#, ref_low, ref_meas,
ref_upp, ref_judge
1030        For mkr = 1 To 8
1040          Print #1, mkr, mkr1_stim(mkr) / 1000000#,
mkr1_low(mkr), mkr1_meas(mkr), mkr1_upp(mkr), mkr1_judge(mkr)
1050        Next mkr
1060        Print #1,
"-------------------------------------------------------------------
------"
1070      Print #1, " total
" & all_judge
1080        Close #1
1090
1100        MsgBox ("Marker Limit Test: " & all_judge)
1110      End If
1120
1130      End
1140
1150    End Sub
```

Equivalent Circuit Analysis

Selecting an Equivalent Circuit Model

The E4991A allows you to select one of the following five types of circuit models to perform equivalent circuit analysis.

Equivalent circuit model type		DUT type	Typical frequency characteristics*1
A		Inductor with high core loss	
B		Inductor and resistor	
C		Resistor with high resistance	
D		Capacitor	
E		Oscillator and resonator	

*1. Measurement parameters: |Z| - θ, Vertical axis format: |Z| indicates Log, and θ indicates Linear.

Use the following GPIB command to select a circuit model type.

- **CALC{1-5}:EPAR:CIRC** on page 296

Performing Equivalent Circuit Analysis

Use the following GPIB command to perform equivalent circuit analysis.

- **CALC{1-5}:EPAR** on page 295

NOTE Equivalent circuit analysis is performed within the range specified for marker search.

Use the following GPIB command in the query format to read equivalent circuit analysis results (equivalent circuit parameters: R1, C1, L1, and C0).

- **CALC{1-5}:EPAR** on page 295

Simulating Frequency Characteristics

The E4991A allows you to simulate frequency characteristics based on the values of the R1, C1, L1, and C0 parameters obtained from the equivalent circuit analysis and display the results as a memory trace on the screen. Use the following GPIB command to simulate frequency characteristics.

- **CALC{1-5}:EPAR:SIM** on page 297

The **CALC{1-5}:EPAR** command can be used to set the R1, C1, L1, and C1 parameters to any value. Therefore, you can use this command to set these parameters to desired values to simulate frequency characteristics and display the results on the screen.

Example Programs for Equivalent Circuit Analysis

Below are example programs of equivalent circuit analysis. After a sweep, the equivalent circuit model is set to E, the equivalent circuit analysis is performed, and the results are read and displayed. In addition, frequency characteristics are simulated using the parameters of the analysis results.

Example program using HTBasic

Example 7-5 shows an example program for the equivalent circuit analysis. This program is saved under the filename circuit.htb on the sample programs disk. Below is an explanation of the program's details.

Line 60	Sets the GPIB address.
Lines 80 - 140	Substitute variables for the sweep range, number of measurement points, trace number, sweep averaging factor, and type of equivalent circuit model.
Line 180	Resets the E4991A.
Lines 200 - 240	Turns on Trace 1 and Trace 2. In addition, sets the measurement parameters for each trace.
Lines 260 - 310	Sets the sweep conditions and sweep averaging function.
Lines 330 - 350	Sets the trigger source to the internal trigger and turns off the continuous activation of the trigger system. Then, it resets the trigger system and sets the trigger sequence to the idle state.
Line 370	Calls the sub-program for executing sweep.
Lines 390 - 400	Executes auto-scale adjustment for the trace.
Lines 420 - 430	Sets the equivalent circuit model and executes the equivalent circuit analysis.
Lines 450 - 580	Reads and displays the values of the equivalent circuit parameter.
Lines 600 - 650	Simulates the frequency characteristics of the equivalent circuit. After that, auto-scale adjustment is executed for both data trace and memory trace.
Lines 690 - 710	Reads the simulation results of the frequency characteristics in the memory trace.
Lines 730 - 780	Saves in the external computer the simulation results of the frequency characteristics that were read.
Lines 820 - 1050	Refer to "Example Programs for Detecting Measurement End" on page 114 for an explanation of the sub-program.

Example 7-5 Equivalent circuit analysis (HTBasic)

```
10      INTEGER Trc1,Trc2,Nop,Swp_count,Data_size
20      DIM Equ_model$[1],Start_f$[9],Stop_f$[9],File$[20]
30      REAL R1,C1,L1,C0,Sim_data_z(1:201),Sim_data_thd(1:201)
40      !
50      CLEAR SCREEN
60      ASSIGN @Agte4991a TO 717
70      !
80      Start_f$="50MHZ"
```

```
90      Stop_f$="150MHZ"
100     Nop=201
110     Trc1=1
120     Trc2=2
130     Swp_count=1
140     Equ_model$="E"
150     !
160     ! E4991A settings
170     !
180     OUTPUT @Agte4991a;"SYST:PRES"
190     !
200     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&" ON"
210     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":FORM Z"
220     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc2)&" ON"
230     OUTPUT @Agte4991a;"CALC"&VAL$(Trc2)&":FORM ZPH"
240     OUTPUT @Agte4991a;"CALC"&VAL$(Trc2)&":FORM:UNIT:ANGL DEG"
250     !
260     OUTPUT @Agte4991a;"SWE:TYPE LIN"
270     OUTPUT @Agte4991a;"FREQ:STAR "&Start_f$
280     OUTPUT @Agte4991a;"FREQ:STOP "&Stop_f$
290     OUTPUT @Agte4991a;"SWE:POIN "&VAL$(Nop)
300     OUTPUT @Agte4991a;"CALC:AVER:COUN "&VAL$(Swp_count)
310     OUTPUT @Agte4991a;"CALC:AVER ON"
320     !
330     OUTPUT @Agte4991a;"TRIG:SOUR INT"
340     OUTPUT @Agte4991a;"INIT:CONT OFF"
350     OUTPUT @Agte4991a;"ABOR"
360     !
370     CALL Sweep(@Agte4991a)
380     !
390     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&":Y:AUTO"
400     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc2)&":Y:AUTO"
410     !
420     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":EPAR:CIRC "&Equ_model$
430     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":EPAR"
440     !
450     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":DATA:EPAR? EQR1"
460     ENTER @Agte4991a;R1
470     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":DATA:EPAR? EQC1"
480     ENTER @Agte4991a;C1
490     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":DATA:EPAR? EQL1"
500     ENTER @Agte4991a;L1
510     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":DATA:EPAR? EQC0"
520     ENTER @Agte4991a;C0
530     !
540     PRINT " --- Result ---"
550     PRINT "R1 :";R1;"[ohm]"
560     PRINT "C1 :";C1;"[F]"
570     PRINT "L1 :";L1;"[H]"
580     PRINT "C0 :";C0;"[F]"
590     !
600     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":EPAR:SIM"
610     OUTPUT @Agte4991a;"CALC"&VAL$(Trc2)&":EPAR:SIM"
620     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&":Y:FOR AND"
630     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc2)&":Y:FOR AND"
640     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc1)&":Y:AUTO"
650     OUTPUT @Agte4991a;"DISP:TRAC"&VAL$(Trc2)&":Y:AUTO"
660     !
```

```
670     OUTPUT @Agte4991a;"FORM:DATA ASC"
680     OUTPUT @Agte4991a;"CALC"&VAL$(Trc1)&":DATA? FMEM"
690     ENTER @Agte4991a;Sim_data_z(*)
700     OUTPUT @Agte4991a;"CALC"&VAL$(Trc2)&":DATA? FMEM"
710     ENTER @Agte4991a;Sim_data_thd(*)
720     !
730     File$="equ_trace"
740     Data_size=(Nop*2)*8
750     CREATE File$,Data_size
760     ASSIGN @File TO File$;FORMAT OFF
770     OUTPUT @File;Sim_data_z(*),Sim_data_thd(*)
780     ASSIGN @File TO *
790     !
800     END
810     !
820     SUB Sweep(@Agte4991a)
830       DIM Buff$[9]
840       INTEGER Swp_bool
850       !
860       OUTPUT @Agte4991a;"CALC:AVER?"
870       ENTER @Agte4991a;Swp_bool
880       IF Swp_bool=1 THEN OUTPUT @Agte4991a;"CALC:AVER:CLE"
890       !
900       OUTPUT @Agte4991a;"STAT:OPER:PTR 0"
910       OUTPUT @Agte4991a;"STAT:OPER:NTR 16"
920       OUTPUT @Agte4991a;"STAT:OPER:ENAB 16"
930       OUTPUT @Agte4991a;"*SRE 128"
940       OUTPUT @Agte4991a;"*CLS"
950       OUTPUT @Agte4991a;"*OPC?"
960       ENTER @Agte4991a;Buff$
970       !
980       ON INTR 7 GOTO Swp_end
990       ENABLE INTR 7;2
1000      OUTPUT @Agte4991a;"INIT"
1010      DISP "Now Measuring..."
1020 Swp_wait: GOTO Swp_wait
1030 Swp_end: DISP "Sweep Complete"
1040      OFF INTR 7
1050    SUBEND
```

Example program using macro (E4991A VBA)

Example 7-6 shows an example program for the equivalent circuit analysis. This program is saved under the filename circuit.bas on the sample programs disk. Below is an explanation of the details of the program.

Lines 120 - 180	Substitutes variables for the sweep range, number of measurement points, trace number, sweep averaging factor, and type of the equivalent circuit model.
Line 220	Resets the E4991A.
Lines 240 - 280	Turns on Trace 1 and Trace 2. In addition, sets the measurement parameters for each trace.
Lines 300 - 350	Sets the sweep conditions and sweep averaging function.
Lines 370 - 390	Sets the trigger source to the internal trigger and turns off the continuous activation of the trigger system. Then, it resets the trigger system and sets the trigger sequence to the idle state.
Lines 410 - 420	Resets sweep averaging when sweep averaging function is set to on.
Line 440	Starts the sweep and substitutes a variable of “bool” for sweep completion.
Lines 450 - 460	Displays a message of “Sweep Aborted” when sweep is aborted (bool=0) during the measurement.
Line 470	Describes the program routine below this line when sweep is completed without problem (bool=1).
Lines 480 - 490	Executes auto-scale adjustment for the specified trace.
Lines 510 - 520	Sets the equivalent circuit model and executes the equivalent circuit analysis.
Lines 540 - 600	Reads and displays the values of the equivalent circuit parameter.
Lines 620 - 670	Simulates the frequency characteristics of the equivalent circuit. After that, auto-scale adjustment is executed for both data trace and memory trace.
Lines 690 - 730	Reads the simulation results of the frequency characteristics in the memory trace.
Lines 750 - 840	Saves the simulation results of the frequency characteristics to a specified file (a:\equ_trace).
Lines 820 - 1050	Stops the execution of the macro.

Example 7-6 **Equivalent circuit analysis (macro)**

```
10      Sub Main()
20        Dim trc1 As Integer, trc2 As Integer, nop As Integer
30        Dim swp_count As Integer, data_size As Integer
40        Dim equ_model As String, start_f As String, stop_f As
String
50        Dim file As String, buff As String
60        Dim r1 As Double, c1 As Double, l1 As Double, c0 As Double
70        Dim sim_data_z As Variant, sim_data_thd As Variant
80        Dim i As Integer, swp_bool As Integer, bool As Integer
90        Dim fileNum As Integer
```

```
100       Dim msg As String
110
120       start_f = "50MHZ"
130       stop_f = "150MHZ"
140       nop = 201
150       trc1 = 1
160       trc2 = 2
170       swp_count = 1
180       equ_model = "E"
190
200       ' E4991A settings
210
220       SCPI.Output "SYST:PRES"
230       '
240       SCPI.Output "DISP:TRAC" & CStr(trc1) & " ON"
250       SCPI.Output "CALC" & CStr(trc1) & ":FORM Z"
260       SCPI.Output "DISP:TRAC" & CStr(trc2) & " ON"
270       SCPI.Output "CALC" & CStr(trc2) & ":FORM ZPH"
280       SCPI.Output "CALC" & CStr(trc2) & ":FORM:UNIT:ANGL DEG"
290
300       SCPI.Output "SWE:TYPE LIN"
310       SCPI.Output "FREQ:STAR " & start_f
320       SCPI.Output "FREQ:STOP " & stop_f
330       SCPI.Output "SWE:POIN " & CStr(nop)
340       SCPI.Output "CALC:AVER:COUN " & CStr(swp_count)
350       SCPI.Output "CALC:AVER ON"
360
370       SCPI.Output "TRIG:SOUR INT"
380       SCPI.Output "INIT:CONT OFF"
390       SCPI.Output "ABOR"
400
410       swp_bool = SCPI.Query("CALC:AVER?")
420       If swp_bool = 1 Then SCPI.Output "CALC:AVER:CLE"
430
440       bool = SingleMeasure
450       If bool = 0 Then
460         MsgBox ("Sweep Aborted")
470       ElseIf bool = 1 Then
480         SCPI.Output "DISP:TRAC" & CStr(trc1) & ":Y:AUTO"
490         SCPI.Output "DISP:TRAC" & CStr(trc2) & ":Y:AUTO"
500
510         SCPI.Output "CALC" & CStr(trc1) & ":EPAR:CIRC " &
equ_model
520         SCPI.Output "CALC" & CStr(trc1) & ":EPAR"
530
540         r1 = SCPI.Query("CALC" & CStr(trc1) & ":DATA:EPAR?
EQR1")
550         c1 = SCPI.Query("CALC" & CStr(trc1) & ":DATA:EPAR?
EQC1")
560         l1 = SCPI.Query("CALC" & CStr(trc1) & ":DATA:EPAR?
EQL1")
570         c0 = SCPI.Query("CALC" & CStr(trc1) & ":DATA:EPAR?
EQC0")
580
590        msg = "Equivarent Circuit Parameters" & vbCrLf & vbCrLf
& "R1=" & CStr(r1) & vbCrLf & "C1=" & CStr(c1) & vbCrLf & "L1=" &
CStr(l1) & vbCrLf & "C0=" & CStr(c0)
600         MsgBox (msg)
```

```
610
620         SCPI.Output "CALC" & CStr(trc1) & ":EPAR:SIM"
630         SCPI.Output "CALC" & CStr(trc2) & ":EPAR:SIM"
640         SCPI.Output "DISP:TRAC" & CStr(trc1) & ":Y:FOR AND"
650         SCPI.Output "DISP:TRAC" & CStr(trc2) & ":Y:FOR AND"
660         SCPI.Output "DISP:TRAC" & CStr(trc1) & ":Y:AUTO"
670         SCPI.Output "DISP:TRAC" & CStr(trc2) & ":Y:AUTO"
680
690         SCPI.Output "FORM:DATA ASC"
700         SCPI.Output "CALC" & CStr(trc1) & ":DATA? FMEM"
710         SCPI.Enter sim_data_z, "#"
720         SCPI.Output "CALC" & CStr(trc2) & ":DATA? FMEM"
730         SCPI.Enter sim_data_thd, "#"
740
750         file = "a:\equ_trace"
760         fileNum = FreeFile
770         Open file For Output As #fileNum
780         For i = 1 To nop
790           Print #fileNum, Val(sim_data_z(i - 1))
800         Next i
810         For i = 1 To nop
820           Print #fileNum, Val(sim_data_thd(i - 1))
830         Next i
840         Close #fileNum
850       End If
860
870       End
880     End Sub
```

8 Save and Recall Files

This chapter explains how to save the Agilent E4991A's measurement condition settings or measurement results to a file and how to later recall them from the file.

Saving and Recalling Files

Current Folder

Basically, file save and recall operations are performed on the specified files in the current folder.

Specifying Current Folder

Use the following GPIB command to change the current folder. In the factory default settings, the current folder is set to “D:\Documents.”

- **MMEM:CDIR** on page 383

Recalling File List

The following GPIB command can be used to recall a list of files in the current folder.

- **MMEM:CAT?** on page 383

Saving Files

The E4991A allows saving the following measurement condition settings and measurement results to a file.

Saved Files

The E4991A provides several GPIB commands corresponding to the types of files to be saved, as shown in the table below.

File type	What is saved	GPIB command
State file (with extension .sta)	Information such as measurement conditions*1 is saved.	**MMEM:STOR** on page 388
Data file (with extension .dat)	The specified internal data array is saved in binary format.	**MMEM:STOR:TRAC** on page 391
Data file (with extension .txt)	The specified internal data array is saved in ASCII format.	**MMEM:STOR:TRAC:ASC** on page 391
Graphics file (with extension .jpg)	Graphical image is saved in the JPEG format.	**MMEM:STOR:GRAP** on page 389
Graphics file (with extension .bmp)	Graphical image is saved in MS Window's bitmap format.	**MMEM:STOR:GRAP:BMP** on page 390
CITIfile (with extension .txt)	The CITIfile of the selected model is saved.	**MMEM:STOR:CITI{1-3}** on page 389
Macro file (with extension .lcr)	A macro is saved.	**MMEM:STOR:MACR** on page 390

*1. This information includes measurement conditions, calibration data array/calibration coefficient array, fixture compensation data array/fixture compensation coefficient array, data array/data trace array, memory array/memory trace array, standard values of a user-defined calibration kit, and standard values of a user-defined fixture compensation kit.

Selecting Internal Data Array

When saving the E4991A's internal data array, use the following GPIB command to select the internal data array to be saved.

- **MMEM:STOR:TRAC:SEL{1-4}** on page 392

Recalling Files

The following GPIB commands can be used to recall measurement condition settings and measurement results.

File type	What is recalled	GPIB command
State file (with extension .sta)	Recalls what was saved with the **MMEM:STOR** command.	**MMEM:LOAD** on page 385
Data file in binary format (with extension .dat)	Recalls an internal data array saved in binary format with the **MMEM:STOR:TRAC** command.	**MMEM:LOAD:TRAC** on page 386
Macro program (with extension .lcr)	Loads a macro that was saved with the **MMEM:STOR:MACR** command.	**MMEM:LOAD:MACR** on page 385

Automatic Recall of State File

If the “D:\” folder contains the state file named “Autorec.sta,” the next time the E4991A starts, the state file is recalled automatically to set up the E4991A in the state defined in this file.

Folder and File Manipulation

The E4991A allows the following operations to manipulate folders and files.

Folders

Create

Use the following GPIB command to create a new folder.

- **MMEM:MDIR** on page 386

Delete

Use the following GPIB command to delete a folder.

- **MMEM:RDIR** on page 388

Files

Rename

Use the following GPIB command to rename an existing file. The original and renamed file names must be specified with an extension.

- **MMEM:MOVE** on page 387

Copy

Use the following GPIB command to duplicate a file. The source and destination file names must be specified with an extension.

- **MMEM:COPY** on page 384

Delete

Use the following GPIB command to delete a specified file. The file to be deleted must be specified with an extension.

- **MMEM:DEL** on page 384

Example Programs for Saving/Recalling a File

Example programs for saving/recalling a file are shown below. A file is saved/recalled by choosing the appropriate sub-program from a menu.

Example program using HTBasic

Example 8-1 shows an example program for saving/recalling a file using HTBasic. This program is saved under the filename save_rec.htb on the sample programs disk. Below is an explanation of the program's details.

Line 50	Sets the GPIB address.
Lines 70 - 390	User calls the sub-program from the menu to save/recall the specified file and changes the current folder for saving/recalling the file.
Lines 450 - 710	Indicates the current folder and makes changes in it in the sub-program Chn_curr_holder. Asks to input the file name again if the folder name is inappropriate.
Lines 730 - 990	Saves the state file under any filename in the sub-program Save_state. Asks to input the file name again if an error occurs while saving the file.
Lines 1010 - 1270	Recalls any state file in the sub-program Recall_state. Asks to input the filename again if an error occurs while recalling the file.
Lines 1290 - 1830	Saves the data file under any filename in the sub-program Save_data. Before saving, selects the kind of internal data array to be saved in the file and the file type (ASCII or binary). Asks to input the filename again if an error occurs while saving the file.
Lines 1850 - 2110	Recalls any data file (in binary format) in the sub-program Recall_data. Asks to input the file name again if an error occurs while recalling the file.
Lines 2130 - 2470	Saves the CITIfile under any filename in the sub-program Save_citi. Selects a model type for the CITIfile before saving. Asks to input the filename again if an error occurs while saving the file.
Lines 2490 - 2830	Saves a graphics file under any filename in the sub-program Save_graphics. Selects saving the measurement display in either bitmap format or JPEG format. Asks to input the file name again if an error occurs while saving the file.

Example 8-1 **Saving/Recalling (HTBasic)**

```
10      DIM File$[256],Inp_chr$[30],Err_mes$[50],Extension$[3]
20      INTEGER Err_no
30      !
40      CLEAR SCREEN
50      ASSIGN @Agte4991a TO 717
60      !
70 Menu: BEEP
80      PRINT "        Save/Recall Menu"
90      PRINT "-------------------------------------"
100     PRINT " 1: return and changes current holder"
110     PRINT " 2: saves state file"
120     PRINT " 3: recall state file"
130     PRINT " 4: saves data file"
140     PRINT " 5: recall data file"
150     PRINT " 6: saves CITIfile"
160     PRINT " 7: saves graphics data"
170     PRINT " 8: quit"
180     PRINT
190     INPUT "Input 1 to 8",Inp_chr$
200     !
210     SELECT Inp_chr$[1,2]
220     CASE "1"
230       CALL Chn_curr_holder(@Agte4991a)
240     CASE "2"
250       CALL Save_state(@Agte4991a)
260     CASE "3"
270       CALL Recall_state(@Agte4991a)
280     CASE "4"
290       CALL Save_data(@Agte4991a)
300     CASE "5"
310       CALL Recall_data(@Agte4991a)
320     CASE "6"
330       CALL Save_citi(@Agte4991a)
340     CASE "7"
350       CALL Save_graphics(@Agte4991a)
360     CASE "8"
370       GOTO Quit
380     END SELECT
390     GOTO Menu
400     !
410 Quit:!
420     END
430     !
440     !
450     SUB Chn_curr_holder(@Agte4991a)
460       DIM Holder$[256],Inp_chr$[30],Err_mes$[50]
470       INTEGER Err_no
480       !
490       OUTPUT @Agte4991a;"MMEM:CDIR?"
500       ENTER @Agte4991a;Holder$
510       PRINT "current holder name: "&Holder$
520       PRINT
530 Input_name:!
540       INPUT "Do you want to change current holder?
[Y/N]",Inp_chr$
```

```
550       IF UPC$(Inp_chr$)="Y" THEN
560         INPUT "Input new current folder name you wish",Holder$
570         Holder$="""&Holder$&"""
580         OUTPUT @Agte4991a;"MMEM:CDIR "&Holder$
590         OUTPUT @Agte4991a;"SYST:ERR?"
600         ENTER @Agte4991a;Err_no,Err_mes$
610         IF Err_no<>0 THEN
620           BEEP
630           PRINT Err_mes$&" occured"
640           PRINT
650           GOTO Input_name
660         ELSE
670           PRINT "new current holder name: "&Holder$
680           PRINT
690         END IF
700       END IF
710     SUBEND
720     !
730     SUB Save_state(@Agte4991a)
740       DIM File$[256],Inp_chr$[30],Err_mes$[50]
750       INTEGER Err_no
760       !
770 Input_name:!
780       INPUT "Input state file name without extension you wish to
save.",File$
790       File$="""&File$&"""
800       PRINT "file name : "&File$
810       PRINT
820       INPUT "Do you want to change file name again?
[Y/N]",Inp_chr$
830       IF UPC$(Inp_chr$)="N" THEN
840         OUTPUT @Agte4991a;"MMEM:STOR "&File$
850         OUTPUT @Agte4991a;"SYST:ERR?"
860         ENTER @Agte4991a;Err_no,Err_mes$
870         IF Err_no<>0 THEN
880           BEEP
890           PRINT Err_mes$&" occured"
900           PRINT
910           GOTO Input_name
920         ELSE
930           PRINT "save done"
940           PRINT
950         END IF
960       ELSE
970         GOTO Input_name
980       END IF
990     SUBEND
1000    !
1010    SUB Recall_state(@Agte4991a)
1020      DIM File$[256],Inp_chr$[30],Err_mes$[50]
1030      INTEGER Err_no
1040      !
1050 Input_name:!
1060      INPUT "Input state file name without extension you wish to
recall.",File$
1070      File$="""&File$&"""
1080      PRINT "file name : "&File$
1090      PRINT
```

```
1100      INPUT "Do you want to change file name again?
[Y/N]",Inp_chr$
1110      IF UPC$(Inp_chr$)="N" THEN
1120        OUTPUT @Agte4991a;"MMEM:LOAD "&File$
1130        OUTPUT @Agte4991a;"SYST:ERR?"
1140        ENTER @Agte4991a;Err_no,Err_mes$
1150        IF Err_no<>0 THEN
1160          BEEP
1170          PRINT Err_mes$&" occured"
1180          PRINT
1190          GOTO Input_name
1200        ELSE
1210          PRINT "recall done"
1220          PRINT
1230        END IF
1240      ELSE
1250        GOTO Input_name
1260      END IF
1270    SUBEND
1280    !
1290    SUB Save_data(@Agte4991a)
1300      DIM
File$[256],Inp_chr$[30],File_type$[30],Err_mes$[50],Bool$[3]
1310      INTEGER I,Err_no
1320      !
1330      PRINT "Select the Save Data Array"
1340      PRINT
1350      FOR I=1 TO 4
1360        SELECT I
1370        CASE 1
1380          INPUT "Do you want to save data array? [Y/N]",Inp_chr$
1390        CASE 2
1400          INPUT "Do you want to save data trace array?
[Y/N]",Inp_chr$
1410        CASE 3
1420          INPUT "Do you want to save memory array? [Y/N]",Inp_chr$
1430        CASE 4
1440          INPUT "Do you want to save memory trace array?
[Y/N]",Inp_chr$
1450        END SELECT
1460        IF UPC$(Inp_chr$)="Y" THEN
1470          OUTPUT @Agte4991a;"MMEM:STOR:TRAC:SEL"&VAL$(I)&" ON"
1480        ELSE
1490          OUTPUT @Agte4991a;"MMEM:STOR:TRAC:SEL"&VAL$(I)&" OFF"
1500        END IF
1510      NEXT I
1520      !
1530      PRINT "Select the File Type, ASCII or Binary"
1540      PRINT
1550      INPUT "Input the first letter of a word [A/B]",File_type$
1560      !
1570  Input_name:!
1580      INPUT "Input data file name without extension you wish to
save.",File$
1590      File$="""&File$&"""
1600      PRINT "file name : "&File$
1610      PRINT
1620      INPUT "Do you want to change file name again?
```

```
[Y/N]",Inp_chr$
1630      IF UPC$(Inp_chr$)="N" THEN
1640        IF UPC$(File_type$[1,1])="A" THEN
1650          OUTPUT @Agte4991a;"MMEM:STOR:TRAC:ASCII "&File$
1660        ELSE
1670          OUTPUT @Agte4991a;"MMEM:STOR:TRAC "&File$
1680        END IF
1690        OUTPUT @Agte4991a;"SYST:ERR?"
1700        ENTER @Agte4991a;Err_no,Err_mes$
1710        IF Err_no<>0 THEN
1720          BEEP
1730          PRINT Err_mes$&" occured"
1740          PRINT
1750          GOTO Input_name
1760        ELSE
1770          PRINT "save done"
1780          PRINT
1790        END IF
1800      ELSE
1810        GOTO Input_name
1820      END IF
1830    SUBEND
1840    !
1850    SUB Recall_data(@Agte4991a)
1860      DIM File$[256],Inp_chr$[30],Err_mes$[50]
1870      INTEGER Err_no
1880      !
1890 Input_name:!
1900      INPUT "Input binary data file name without extension you
wish to recall.",File$
1910      File$="""&File$&"""
1920      PRINT "file name : "&File$
1930      PRINT
1940      INPUT "Do you want to change file name again?
[Y/N]",Inp_chr$
1950      IF UPC$(Inp_chr$)="N" THEN
1960        OUTPUT @Agte4991a;"MMEM:LOAD:TRAC "&File$
1970        OUTPUT @Agte4991a;"SYST:ERR?"
1980        ENTER @Agte4991a;Err_no,Err_mes$
1990        IF Err_no<>0 THEN
2000          BEEP
2010          PRINT Err_mes$&" occured"
2020          PRINT
2030          GOTO Input_name
2040        ELSE
2050          PRINT "recall done"
2060          PRINT
2070        END IF
2080      ELSE
2090        GOTO Input_name
2100      END IF
2110    SUBEND
2120    !
2130    SUB Save_citi(@Agte4991a)
2140      DIM File$[256],Inp_chr$[30],File_type$[30],Err_mes$[50]
2150      INTEGER Model,Err_no
2160      !
2170      PRINT "Select the model of the CITIfile as follows;"
```

```
2180     PRINT
2190     PRINT "1: 1 Port"
2200     PRINT "2: 2 Port Series"
2210     PRINT "3: 2 Port Shunt"
2220     PRINT
2230     INPUT "Select the CITIfile model type [1-3]",Model
2240     !
2250 Input_name:!
2260     INPUT "Input CITIfile name without extension you wish to
save.",File$
2270     File$="""&File$&"""
2280     PRINT "file name : "&File$
2290     PRINT
2300     INPUT "Do you want to change file name again?
[Y/N]",Inp_chr$
2310     IF UPC$(Inp_chr$)="N" THEN
2320       OUTPUT @Agte4991a;"MMEM:STOR:CITI"&VAL$(Model)&" "&File$
2330       OUTPUT @Agte4991a;"SYST:ERR?"
2340       ENTER @Agte4991a;Err_no,Err_mes$
2350       IF Err_no<>0 THEN
2360         BEEP
2370         PRINT Err_mes$&" occured"
2380         PRINT
2390         GOTO Input_name
2400       ELSE
2410         PRINT "save done"
2420         PRINT
2430       END IF
2440     ELSE
2450       GOTO Input_name
2460     END IF
2470   SUBEND
2480   !
2490   SUB Save_graphics(@Agte4991a)
2500     DIM File$[256],Inp_chr$[30],File_type$[30],Err_mes$[50]
2510     INTEGER Err_no
2520     !
2530     PRINT "Select the File Type, BMP or JPEG"
2540     PRINT
2550     INPUT "Input the first letter of a word [B/J]",File_type$
2560     !
2570 Input_name:!
2580     INPUT "Input data file name without extension you wish to
save.",File$
2590     File$="""&File$&"""
2600     PRINT "file name : "&File$
2610     PRINT
2620     INPUT "Do you want to change file name again?
[Y/N]",Inp_chr$
2630     IF UPC$(Inp_chr$)="N" THEN
2640       IF UPC$(Inp_chr$[1,1])="B" THEN
2650         OUTPUT @Agte4991a;"MMEM:STOR:GRAP:BMP "&File$
2660       ELSE
2670         OUTPUT @Agte4991a;"MMEM:STOR:GRAP "&File$
2680       END IF
2690       OUTPUT @Agte4991a;"SYST:ERR?"
2700       ENTER @Agte4991a;Err_no,Err_mes$
2710       IF Err_no<>0 THEN
```

```
2720          BEEP
2730          PRINT Err_mes$&" occured"
2740          PRINT
2750          GOTO Input_name
2760        ELSE
2770          PRINT "save done"
2780          PRINT
2790        END IF
2800      ELSE
2810        GOTO Input_name
2820      END IF
2830    SUBEND
```

Example program using macro (E4991A VBA)

Example 8-2 shows an example program for saving/recalling a file using a Macro. This program is saved under the filename save_rec.bas on the sample programs disk. Below is an explanation of the program's details.

Lines 80 - 400 User selects the menu item for saving/recalling the specified file and changes the current folder.

Lines 460 - 730 Displays the current folder and makes changes in it in the procedure (Chn_curr_holder). Asks to input the file name again if the folder name is inappropriate.

Lines 750 - 1020 Saves the state file under any filename in the procedure (Save_state). Asks to input the file name again if an error occurs while saving the file.

Lines 1040 - 1320 Recalls the state file in the procedure (Recall_state). Asks to input the filename again if an error occurs while recalling the file.

Lines 1340 - 1880 Saves the data file under any filename in the procedure (Save_data). Before saving, selects the kind of internal data array to be saved in the file and the file type (ASCII or binary). Asks to input the filename again if an error occurs while saving the file.

Lines 1900 - 2170 Recalls the data file (in binary format) in the procedure (Recall_data). Asks to input the file name again if an error occurs while recalling the file.

Lines 2190 - 2550 Saves the CITIfile under any filename in the procedure (Save_citi). Selects a model type for the CITIfile before saving. Asks to input the filename again if an error occurs while saving the file.

Lines 2570 - 2950 Saves the graphics file under any filename in the procedure (Save_graphics). Selects saving the measurement display in either bitmap format or JPEG format. Asks to input the file name again if an error occurs while saving the file.

Example 8-2 Saving/Recalling (macro)

```
10      Sub Main()
20        Dim msg1 As String, msg2 As String, msg3 As String
30        Dim msg4 As String, msg5 As String, msg6 As String
40        Dim msg7 As String, msg8 As String, msg9 As String
50        Dim msg10 As String
60        Dim ans As String
70
80      menu:
90        msg1 = "           Save/Recall Menu" & vbCrLf
100       msg2 = "------------------------------" & vbCrLf
110       msg3 = "1: returns/changes current holder" & vbCrLf
120       msg4 = "2: saves state file" & vbCrLf
130       msg5 = "3: recalls state file" & vbCrLf
140       msg6 = "4: saves data file" & vbCrLf
150       msg7 = "5: recall data file" & vbCrLf
160       msg8 = "6: saves CITIfile" & vbCrLf
170       msg9 = "7: saves graphics data file" & vbCrLf
180       msg10 = "8: quit" & vbCrLf
190       ans = InputBox(msg1 & msg2 & msg3 & msg4 & msg5 & msg6 &
```

```
msg7 & msg8 & msg9 & msg10, "file menu")
200
210       Select Case ans
220       Case "1"
230         Call chn_curr_holder
240       Case "2"
250         Call save_state
260       Case "3"
270         Call recall_state
280       Case "4"
290         Call save_data
300       Case "5"
310         Call recall_data
320       Case "6"
330         Call save_citi
340       Case "7"
350         Call save_graphics
360       Case "8", ""
370         GoTo menu_end
380       End Select
390
400       GoTo menu
410
420     menu_end:
430       End
440     End Sub
450
460     Private Sub chn_curr_holder()
470       Dim msg As String, holder As String, err_mes As String
480       Dim err_no As Integer
490
500       SCPI.Output "MMEM:CDIR?"
510       SCPI.Enter holder
520     input_name:
530        msg = "current holder name: " & holder & vbCrLf & vbCrLf &
"Do you want to change the current holder?"
540       ans = MsgBox(msg, vbYesNo)
550       If ans = vbYes Then
560         msg = "Input new current holder name you wish."
570         holder = InputBox(msg, "holder name")
580         If holder = "" Then GoTo input_end
590         holder = """" & holder & """"
600         SCPI.Output "*CLS"
610         SCPI.Output "MMEM:CDIR " & holder
620         SCPI.Output "SYST:ERR?"
630         SCPI.Enter err_no, "#"
640         SCPI.Enter err_mes
650         If err_no <> 0 Then
660           MsgBox (err_mes & "occured")
670           GoTo input_name
680         ElseIf err_no = 0 Then
690           MsgBox ("new holder name: " & holder)
700         End If
710       End If
720     input_end:
730     End Sub
740
750     Private Sub save_state()
```

```
760       Dim msg As String, file As String, err_mes As String
770       Dim err_no As Integer
780
790     input_name:
800       msg = "Input the state file name without extension you wish
to save."
810       file = InputBox(msg, "file name")
820       If file = "" Then GoTo input_end
830       file = """ & file & """
840       msg = "file name : " & file & vbCrLf & vbCrLf & "Do you
want to change the file name again?"
850       ans = MsgBox(msg, vbYesNo)
860       If ans = vbNo Then
870         SCPI.Output "*CLS"
880         SCPI.Output "MMEM:STOR " & file
890         SCPI.Output "SYST:ERR?"
900         SCPI.Enter err_no, "#"
910         SCPI.Enter err_mes
920         If err_no <> 0 Then
930           MsgBox (err_mes & "occured")
940           GoTo input_name
950         ElseIf err_no = 0 Then
960           MsgBox ("save done")
970         End If
980       ElseIf ans = vbYes Then
990         GoTo input_name
1000      End If
1010    input_end:
1020    End Sub
1030
1040    Private Sub recall_state()
1050      Dim msg As String, file As String, err_mes As String
1060      Dim err_no As Integer
1070
1080    input_name:
1090      msg = "Input the state file name without extension you
wish to recall."
1100      file = InputBox(msg, "file name")
1110      If file = "" Then GoTo input_end
1120      file = """ & file & """
1130      msg = "file name : " & file & vbCrLf & vbCrLf & "Do you
want to change the file name again?"
1140      msg = "Do you want to change file name again?"
1150      ans = MsgBox(msg, vbYesNo)
1160      If ans = vbNo Then
1170        SCPI.Output "*CLS"
1180        SCPI.Output "MMEM:LOAD " & file
1190        SCPI.Output "SYST:ERR?"
1200        SCPI.Enter err_no, "#"
1210        SCPI.Enter err_mes
1220        If err_no <> 0 Then
1230          MsgBox (err_mes & "occured")
1240          GoTo input_name
1250        ElseIf err_no = 0 Then
1260          MsgBox ("recall done")
1270        End If
1280      ElseIf ans = vbYes Then
1290        GoTo input_name
```

```
1300      End If
1310    input_end:
1320    End Sub
1330
1340    Private Sub save_data()
1350      Dim msg As String, file As String, file_type As String
1360      Dim err_mes As String, bool As String
1370      Dim i As Integer, err_no As Integer
1380
1390      For i = 1 To 4
1400        Select Case i
1410        Case 1
1420          ans = MsgBox("Do you want to save the data array?",
vbYesNo)
1430        Case 2
1440          ans = MsgBox("Do you want to save the data trace
array?", vbYesNo)
1450        Case 3
1460          ans = MsgBox("Do you want to save the memory array?",
vbYesNo)
1470        Case 4
1480          ans = MsgBox("Do you want to save the memory trace
array?", vbYesNo)
1490        End Select
1500        If asn = vbYes Then
1510          SCPI.Output "MMEM:STOR:TRAC:SEL" & CStr(i) & " ON"
1520        ElseIf ans = vbNo Then
1530          SCPI.Output "MMEM:STOR:TRAC:SEL" & CStr(i) & " OFF"
1540        End If
1550      Next i
1560
1570      msg = "Select the File type, ASCII or Binary." & vbCrLf &
vbCrLf & "Input the first letter of a word [A/B]"
1580      file_type = InputBox(msg, "file type")
1590      If file_type = "" Then GoTo input_end
1600
1610    input_name:
1620      msg = "Input the data file name without extension you wish
to save."
1630      file = InputBox(msg, "file name")
1640      If file = "" Then GoTo input_end
1650      file = """ & file & """
1660      msg = "file name : " & file & vbCrLf & vbCrLf & "Do you
want to change the file name again?"
1670      ans = MsgBox(msg, vbYesNo)
1680      If ans = vbNo Then
1690        SCPI.Output "*CLS"
1700        If UCase(file_type) = "A" Then
1710          SCPI.Output "MMEM:STOR:TRAC:ASC " & file
1720        ElseIf UCase(file_type) = "B" Then
1730          SCPI.Output "MMEM:STOR:TRAC " & file
1740        End If
1750        SCPI.Output "SYST:ERR?"
1760        SCPI.Enter err_no, "#"
1770        SCPI.Enter err_mes
1780        If err_no <> 0 Then
1790          MsgBox (err_mes & "occured")
1800          GoTo input_name
```

```
1810        ElseIf err_no = 0 Then
1820          MsgBox ("save done")
1830        End If
1840      ElseIf ans = vbYes Then
1850        GoTo input_name
1860      End If
1870    input_end:
1880    End Sub
1890
1900    Private Sub recall_data()
1910      Dim msg As String, file As String, err_mes As String
1920      Dim err_no As Integer
1930
1940    input_name:
1950      msg = "Input the binary data file file name without
extension you wish to recall."
1960      file = InputBox(msg, "file name")
1970      If file = "" Then GoTo input_end
1980      file = """ & file & """
1990      msg = "Do you want to change the file name again?"
2000      ans = MsgBox(msg, vbYesNo)
2010      If ans = vbNo Then
2020        SCPI.Output "*CLS"
2030        SCPI.Output "MMEM:LOAD:TRAC " & file
2040        SCPI.Output "SYST:ERR?"
2050        SCPI.Enter err_no, "#"
2060        SCPI.Enter err_mes
2070        If err_no <> 0 Then
2080          MsgBox (err_mes & "occured")
2090          GoTo input_name
2100        ElseIf err_no = 0 Then
2110          MsgBox ("recall done")
2120        End If
2130      ElseIf ans = vbYes Then
2140        GoTo input_name
2150      End If
2160    input_end:
2170    End Sub
2180
2190    Private Sub save_citi()
2200      Dim msg1 As String, msg2 As String, msg3 As String, msg4
As String
2210      Dim file As String, model As String
2220      Dim err_mes As String, bool As String
2230      Dim err_no As Integer
2240
2250    input_name:  '
2260      msg1 = "Select the model of the CITIfile as follows
[1-3];" & vbCrLf & vbCrLf
2270      msg2 = "1: 1 port" & vbCrLf
2280      msg3 = "2: 2 port Series" & vbCrLf
2290      msg4 = "3: 2 port Shunt"
2300      model = InputBox(msg1 & msg2 & msg3 & msg4, "CITIfile
type")
2310      If model = "" Then GoTo input_end
2320
2330      msg = "Input CITIfile name without extension you wish to
save."
```

```
2340      file = InputBox(msg, "file name")
2350      If file = "" Then GoTo input_end
2360      file = """ & file & """
2370      msg = "file name : " & file & vbCrLf & vbCrLf & "Do you
want to change the file name again?"
2380      ans = MsgBox(msg, vbYesNo)
2390      If ans = vbNo Then
2400        SCPI.Output "*CLS"
2410        SCPI.Output "MMEM:STOR:CITI" & CStr(model) & " " & file
2420        SCPI.Output "SYST:ERR?"
2430        SCPI.Enter err_no, "#"
2440        SCPI.Enter err_mes
2450        If err_no <> 0 Then
2460          MsgBox (err_mes & "occured")
2470          GoTo input_name
2480        ElseIf err_no = 0 Then
2490          MsgBox ("save done")
2500        End If
2510      ElseIf ans = vbYes Then
2520        GoTo input_name
2530      End If
2540    input_end:
2550    End Sub
2560
2570    Private Sub save_graphics()
2580      Dim msg As String, file As String, file_type As String
2590      Dim err_mes As String, bool As String
2600      Dim err_no As Integer
2610
2620      msg = "Select the File type, BMP or JPEG." & vbCrLf &
vbCrLf & "Input the first letter of a word [B/J]"
2630      file_type = InputBox(msg, "file type")
2640      If file_type = "" Then GoTo input_end
2650
2660    input_name:
2670      msg = "Input the graphics file name without extension you
wish to save."
2680      file = InputBox(msg, "file name")
2690      If file = "" Then GoTo input_end
2700      file = """ & file & """
2710      msg = "file name : " & file & vbCrLf & vbCrLf & "Do you
want to change the file name again?"
2720      ans = MsgBox(msg, vbYesNo)
2730      If ans = vbNo Then
2740        SCPI.Output "*CLS"
2750        If UCase(file_type) = "B" Then
2760          SCPI.Output "MMEM:STOR:GRAP:BMP " & file
2770        ElseIf UCase(file_type) = "J" Then
2780          SCPI.Output "MMEM:STOR:GRAP " & file
2790        End If
2800        SCPI.Output "SYST:ERR?"
2810        SCPI.Enter err_no, "#"
2820        SCPI.Enter err_mes
2830        If err_no <> 0 Then
2840          MsgBox (err_mes & "occured")
2850          GoTo input_name
2860        ElseIf err_no = 0 Then
2870          MsgBox ("save done")
```

```
2880        End If
2890      ElseIf ans = vbYes Then
2900        GoTo input_name
2910      End If
2920
2930    input_end:
2940
2950    End Sub
```

9 Using Printer

This chapter explains how to use a printer connected to the Agilent E4991A to print out measurement results and other information from the instrument.

Printing out to a Printer Connected to E4991A

The E4991A allows the user to print out, for example, the graphical images displayed on the LCD screen. For details on how to connect a printer and available printers, refer to the **operation manual**.

Selecting Print Contents

The following information can be printed out to a printer.

Print Content	Description
Graphical images on the screen	When a measurement data graph is displayed, graphical images are printed out in either color or monochrome.
Measurement result list	Measurement data at all measurement points are printed out in text format in monochrome only.
Settings information	Major setting parameters are printed out in text format in monochrome only.

Use the following command to select the desired print content.

- **HCOP:CONT** on page 380

Selecting Color

The following command can be used to select the color in which the chosen content is printed. If print content other than graphical images is selected, it can only be printed in monochrome regardless of the command parameter.

- **HCOP:IMAG** on page 381

Color	Description
Color (Inverted color)	Printed in inverted screen color.
Monochrome (Reverse video)	Printed in gray scale inversion.

Performing Printout

Use the following GPIB command to print out the information to a printer.

- **HCOP** on page 380

Cancelling Printing

Use the following GPIB command to cancel printing.

- **HCOP:ABOR** on page 380

10 Setting the Display

This chapter explains how to set the display screen of the Agilent E4991A.

Setting the Display

The E4991A provides several GPIB commands that can be applied to the entire screen (all windows) or to a specific trace.

GPIB Commands for Entire Screen (windows)

Enable/Disable Update of Displayed Information

The following GPIB command can be used to enable/disable update of the entire screen.

- **DISP:ENAB** on page 354

Switch between Split Window and Overlay (Scalar Trace)

When several traces are displayed in a scalar trace, the following GPIB command can be used to select whether one trace is displayed within one of the split windows or all of the traces are displayed overlaid in one window.

- **DISP:FORM** on page 355

Disable Backlight

The E4991A is equipped with an LCD with a backlight for increased visibility. The following GPIB command can be used to switch between turning the backlight on and off. Note that disabling the backlight results in no visibility.

- **DISP:BACK** on page 354

GPIB Commands for Traces

Set Active Trace

Use the following GPIB command to set the active trace.

- **DISP:TRAC{1-5}:SEL** on page 358

Select Measurement Display Screen

Use the following GPIB command to select whether the measurement screen is displayed in the graph or text (list) format.

- **DISP:TRAC{1-5}:TEXT** on page 359

In the text format, the following GPIB command can be used to scroll through the screen.

- **DISP:TRAC{1-5}:TEXT:PAGE** on page 359

Use Memory Trace

Use the following GPIB command to copy the measurement data to the memory trace.

- **CALC{1-5}:MATH:MEM** on page 341

Select Trace to Be Displayed

If measurement data is not copied to memory, only the data trace can be displayed on the screen. If measurement data is copied to memory, one of the following can be selected for display on the screen.

- Data trace
- Memory trace
- Data trace and memory trace
- Operation results between data trace and memory trace

Use the following GPIB command to select the trace(s) to be displayed.

- **CALC{1-5}:MATH:FUNC** on page 340

Set Offset (Scalar Trace)

Scalar trace allows you to display the results obtained by subtracting any offset value from a data trace value. Use the following GPIB command to set the offset value. Note that the offset value can be set for each parameter.

- **CALC{1-3}:MATH:OFFS** on page 342

Enter and Display Trace Title

Any title can be displayed in the title area at the top of the window.

Use the following GPIB command to enter a title (string).

- **DISP:TRAC{1-5}:TITL:DATA** on page 361

Use the following GPIB command to display the title.

- **DISP:TRAC{1-5}:TITL** on page 360

When Data Trace Is Refreshed

The timing used for refreshing the data trace can be set to any point. When you want to update trace data frequently, use the following GPIB command to specify when it should be refreshed.

Refresh for Each Sweep

Use the following GPIB command to specify that the data trace be refreshed each time sweep is completed.

- **SYST:IND:SWE:SET** on page 519

Refresh for Each Measurement Point

Use the following GPIB command to specify that the data trace be refreshed each time measurement is completed at a measurement point.

- **SYST:IND:POIN:SET** on page 519

Refresh Periodically

Use the following GPIB command to specify that the data trace be refreshed periodically regardless of measurement.

- **SYST:IND:TIME:SET** on page 521

If the data trace display is refreshed periodically, use the following GPIB command to set the interval.

- **SYST:IND:TIME** on page 520

11 Error Handling

This chapter describes how the Agilent E4991A handles errors in program execution.

Using the Error Queue

The error queue contains the error numbers and messages of any errors that have occurred, which could provide very useful information depending on the circumstances. Use the following GPIB command to read the error queue.

- **SYST:ERR?** on page 517

Also, the following GPIB command can be used to obtain the number of errors in the queue.

- **SYST:ERR:COUN?** on page 518

The error queue can be used in the following ways.

1. Based on the information from the error queue, you can decide how to branch a program. By reading the error queue, you can easily determine whether an error has occurred; if no error has occurred, an error number of 0 and an error message of “No error” are returned. The error queue can also be used to set a program to perform error handling only when a certain type of error occurs.
2. If an error is detected using SRQ, the error queue can be used to investigate the type of error. For how to use SRQ, refer to Example 11-1.

Using Status Report Mechanism

The E4991A's status can be monitored through a set of status registers. The Standard Event Status Register indicates whether an error has occurred. A program uses SRQ (Service Request) to detect an error based on the information from these registers.

To detect an error with SRQ, use the following GPIB commands.

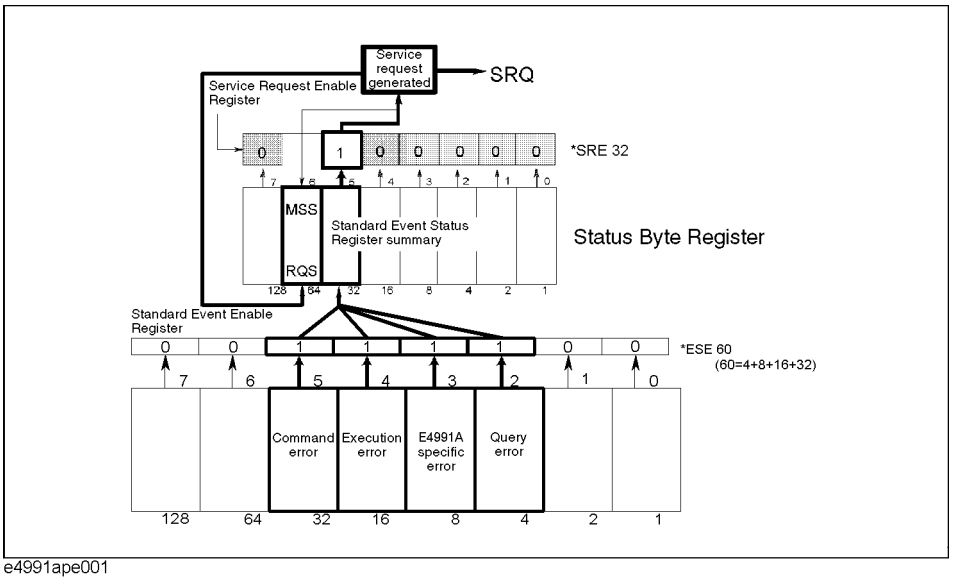
- ***SRE** on page 283
- ***ESE** on page 280

Then perform the following procedure.

Step 1. Configure the E4991A to generate SRQ when one of the error bits in the Standard Event Status Register is set to 1.

Step 2. When SRQ is generated, a program generates an interrupt.

Figure 11-1 SRQ Generation Sequence (when error has occurred)


Service request generated
SRQ
Service Request Enable Register
0 1 0 0 0 0 0
*SRE 32
7 6 5 4 3 2 1 0
MSS
RQS
Standard Event Status Register summary
Status Byte Register
128 64 32 16 8 4 2 1
Standard Event Enable Register
0 0 1 1 1 1 0 0
*ESE 60
(60=4+8+16+32)
7 6 5 4 3 2 1 0
Command error
Execution error
E4991A specific error
Query error
128 64 32 16 8 4 2 1

e4991ape001

Example Program for Error Handling

Using HTBasic

Example 11-1 shows a program that uses SRQ to detect an error. This program is saved as error.htb on the sample programs disk.

After setting SRQ, this program intentionally generates an error by issuing an invalid command not provided by the E4991A and performs error handling. In the error handling, it reads the error queue to investigate and display an error number and an error message as well as outputs a message to the effect that the program will be aborted.

Line 40	Sets the GPIB address of the E4991A attached to the GPIB interface card with the select code of 7.
Lines 60 - 70	Enables the bits 2,3,4, and 5 of the Standard Event Status Register and sets the bit 5 of the Service Request Enable Register to 1.
Lines 80 - 100	Clears the Status Byte Register, the Standard Event Status Register, and the error queue.
Lines 120 - 130	Causes a branch when an interrupt is generated on the interface card with the select code of 7 and enables SRQ interrupt.
Lines 140 - 210	Sets sweep type and start and stop values of the frequency sweep range, but the invalid command to set the stop value causes an error.
Line 220	Skips the error handling process when no error occurs.
Lines 230 - 250	Error handling. The GO TO statement defined in Line 120 causes the program to branch here. The number and the message of the error that has occurred are read.
Lines 260 - 280	Displays a message saying that an error has occurred, an error number, error description, and a message saying that the program is aborted.
Line 300	Displays a message saying that the program has ended. However, the program does not actually reach this point unless you repair the program and rerun it.

Example 11-1 **Error Detection Using SRQ**

```
10      DIM Buff$[9],Err_mes$[50]
20      INTEGER Err_no
30      !
40      ASSIGN @Agte4991a TO 717
50      !
60      OUTPUT @Agte4991a;"*ESE 60"
70      OUTPUT @Agte4991a;"*SRE 32"
80      OUTPUT @Agte4991a;"*CLS"
90      OUTPUT @Agte4991a;"*OPC?"
100     ENTER @Agte4991a;Buff$
110     !
120     ON INTR 7 GOTO Err_proc
130     ENABLE INTR 7;2
140     OUTPUT @Agte4991a;"SWE:TYPE LOG"
150     PRINT "Set Sweep Type      :LOG"
```

```
160    OUTPUT @Agte4991a;"FREQ:STAR 1MHZ"
170    PRINT "Set Start Frequency:1MHz"
180    OUTPUT @Agte4991a;"FREQ*STOP 3GHZ"
190    PRINT "Set Stop Frequency :3GHz"
200    OUTPUT @Agte4991a;"*OPC?"
210    ENTER @Agte4991a;Buff$
220    GOTO Skip_err_proc
230 Err_proc: OFF INTR 7
240    OUTPUT @Agte4991a;"SYST:ERR?"
250    ENTER @Agte4991a;Err_no,Err_mes$
260    PRINT "Error occurred!!"
270    PRINT "  No:";Err_no,"Description: "&Err_mes$
280    PRINT "PROGRAM INTERRUPT!!"
290    GOTO Prog_end
300 Skip_err_proc: PRINT "PROGRAM DONE!"
310 Prog_end: END
```

Using the macro (E4991A VBA)

Example 11-2 shows a program that uses an event to detect an error from the E4991A. This program performs error handling when the E4991A shows a measurement failure. It generates an error message and stops execution of the macro.

This program is saved as error.bas (lines 10 - 300) and bsc_meas.cls (lines 1000 - 4050) on the sample programs disk.

Lines 40 - 50	Defines the variable Err to use for the event created in the class module (class name: clsErr). Next, sets the object variable (Err.Evnt) to the E4991A library.
Line 130	Clears the Status Byte Register, the Standard Event Status Register, and the error queue.
Lines 140 - 160	Turns on Trace 1 and activates the sweep averaging function.
Lines 180 - 200	Sets the trigger source for the internal trigger and turns off the continuous activation of the trigger system. Then, resets the trigger system and sets the trigger sequence to the idle state.
Lines 220 - 230	Reads the on/off status of the sweep averaging function and substitutes a variable for the status. Next, when the sweep averaging function is set on, resets the averaging and returns the averaging counter to zero.
Lines 250 - 260	Starts the sweep and substitutes a variable for sweep completion. Displays a message of “Sweep Aborted” when sweep is aborted during the measurement.
Line 280	Disassociates the object variable used for the event function.
Line 1000	Defines the variable (Evnt) as the Public type so that the event procedure can be used in different procedures.
Lines 2000 - 2050	Terminates the program when a “PLL unlock” error occurs inside the E4991A.
Lines 3000 - 3050	Terminates the program when a “DC bias overload” error occurs inside the E4991A.
Lines 4000 - 4050	Forces the program to end when the “RF overload” error occurs inside the E4991A.

Example 11-2 **Error Detection Using Event**

```
10      Sub Main()
20        Dim trc As Integer
30        Dim swp_count As Integer, swp_bool As Integer, bool As
Integer
40
50        Dim Err As New clsErr
60        Set Err.Evnt = New E4991ALib.Application
70
80        trc = 1
90        swp_count = 16
100
110       ' E4991A settings
120
130       SCPI.Output "*CLS"
140       SCPI.Output "DISP:TRAC" & CStr(trc) & " ON"
```

```
150       SCPI.Output "CALC:AVER:COUN " & CStr(swp_count)
160       SCPI.Output "CALC:AVER ON"
170
180       SCPI.Output "TRIG:SOUR INT"
190       SCPI.Output "INIT:CONT OFF"
200       SCPI.Output "ABOR"
210
220       swp_bool = SCPI.Query("CALC:AVER?")
230       If swp_bool = 1 Then SCPI.Output "CALC:AVER:CLE"
240
250       bool = SingleMeasure
260       If bool = 0 Then MsgBox ("Sweep Aborted")
270
280       Set Err.Evnt = Nothing
290
300 End Sub


1000    Public WithEvents Evnt As E4991ALib.Application

2000    Private Sub Evnt_Unlocked()
2010
2020      MsgBox "Error: PLL Unlock" & vbCrLf & vbCrLf & "Program
interruption", vbExclamation, "E4991A Internal Error"
2030      End
2040
2050    End Sub

3000    Private Sub Evnt_DcBiasOverload()
3010
3020      MsgBox "Error: Dc bias overload" & vbCrLf & vbCrLf &
"Program interruption", vbExclamation, "E4991A Internal Error"
3030      End
3040
3050    End Sub

4000    Private Sub Evnt_RfOverload()
4010
4020      MsgBox "Error: RF overload" & vbCrLf & vbCrLf & "Program
interruption", vbExclamation, "E4991A Internal Error"
4030      End
4040
4050    End Sub
```

12 Shutting Down the Instrument

This chapter explains how to properly shut down the Agilent E4991A.

Shutdown Procedure

The following GPIB command can be used to remotely shut down the E4991A. This command cannot be used to the instrument's power on.

- **SYST:POFF** on page 523

When the above command is used to shut down the E4991A, the standby switch remains pressed, unlike when the instrument is shut down by using the standby switch on the front panel. To turn the power on again from this state, use one of the following methods.

- Return the standby switch to the off state and then turn it on again.
- Stop supplying power to the E4991A and then supply power again. The simplest way to do this is to unplug the power cord attached to the rear panel.

NOTE

Once the above command is executed, the same shutdown process of the E4991A is performed as when the standby switch is pressed. For details on cautions when shutting down the instrument, refer to the *Operation Manual.*

13 Use of Macros

This chapter explains how to use the macro function of the Agilent E4991A to create macro programs with the Visual Basic editor. Information is also given on how to execute produced macros.

Overview of Macros

The E4991A is loaded with a macro function. A macro program allows you to automatically execute a series of multiple commands by performing a single command. A macro allows you to combine the steps in a complicated procedure into a single step for a wide variety of applications as well as to control peripheral equipment.

E4991A VBA (Visual BASIC for Application), which is based on Microsoft's Visual Basic, is the programming language used to execute macro functions. Macro commands are written with the Visual Basic Editor (VBE). However, this manual does not explain issues such as basic E4991A VBA programming, standard control, and functions. For more details, please refer to the E4991A VBA on-line help. You can also find up-to date information on VB from a variety of recent books, including the official manual issued by Microsoft Co., Ltd. Another information source is the Internet, including Microsoft's web page at the following URL:

http://msdn.microsoft.com/vbasic

Macro Function Overview

By using the macro function, you can execute the following operations.

1. Control the E4991A

   From E4991A VBA through COM object, you can control the E4991A.

2. Control peripheral equipment

   You can use a macro (E4991A VBA) to control peripheral equipment connected through the USB/GPIB interface of the E4991A.

3. Automate formulaic processes that are used repeatedly

   By using a macro, you can organize multiple processes of the E4991A into a single process. For example, it is possible to automate the resetting of measurement conditions such as sweep range and measurement averaging numbers within the program and repeat the measurement. This makes operations easier and prevents operation errors from occurring. Also, if you compose the formulaic parts of a program as a module, you can call it for reuse from another program, which can be an effective use of program assets.

4. User interface through dialog boxes

   By using the user form, which is one of the key features of E4991A VBA, you can construct a visual user interface. Even if the user is not used to the operations of the E4991A, he or she can follow the direction displayed on the screen, execute the measurement, and input the data. Therefore, you can prevent operation errors due to user mistakes.

Starting Up and Closing Visual Basic Editor

Visual Basic Editor is software used for making and editing macros. The following procedures explain how to start up and quit Visual Basic Editor.

Starting up Visual Basic Editor

Start up Visual Basic Editor as follows.

Step 1. From the measurement screen of the E4991A, use the following menu command.

Utility - Visual Basic Editor...

You can also start the program by typing **[Alt]** + **[F11]** from the keyboard.

Quitting Visual Basic Editor

Although Visual Basic is hidden from view, it remains in memory. You can close Visual Basic Editor as follows.

Step 1. Use the following menu command. After Visual Basic Editor is closed, the E4991A measurement screen again appears on the display.

File - Close and Return to E4991A

You can also quit the program by typing **[Alt]** + **[Q]** from the keyboard.

Displaying the E4991A measurement screen

Even if Visual Basic Editor is running, you can still display the E4991A measurement screen.

Step 1. From the Visual Basic Editor, use the following menu command.

View - E4991A

You can also display the E4991A measurement screen by typing **[Alt]** + **[F11]** from the keyboard.

Making/Editing Macros

The actual steps in making macros are briefly explained here. Only the basics of using E4991A VBA are explained, so when you make an actual macro, please refer to E4991A VBA help.

Elements of Visual Basic Editor

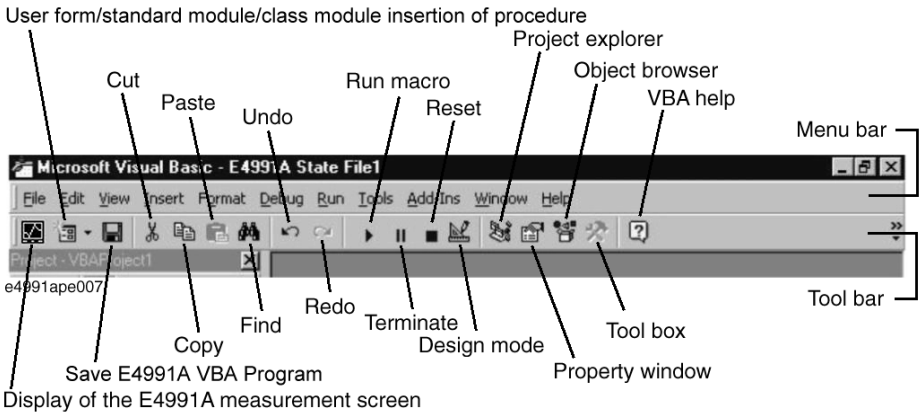
Each major part of Visual Basic Editor and its operations are explained here.

Tool bar

In the initial setup of Visual Basic Editor, the standard tool bar shown below is displayed. The frequently used commands called by the menu bar are also shown as icons on the tool bar.

The operations of Visual Basic Editor are explained below with reference to the menu bar. Icons on the tool bar naturally operate in the same way as their corresponding menu commands.

Figure 13-1 **Standard tool bar**



Window right after startup

When Visual Basic Editor is started up, several windows are initially displayed. Here, the most important windows are described.

- Project explorer

  A list of macros (modules) made or loaded by Visual Basic Editor is displayed here. Module is explained under “Module” on page 221.

- Property window

  In E4991A VBA, a program is represented on the user form by either a command button, called a “control,” or a text box. For example, you can set up a program to start measurement whenever the command button labeled “Measure” is pressed.

  The property window also displays the settings for altering the color and size of controls such as the command buttons on the user form. A control is called an object in E4991A VBA, and the color and size of the object are called properties. In order to set up the value of a property, the following is given.

  Object name.Property name = Setting value

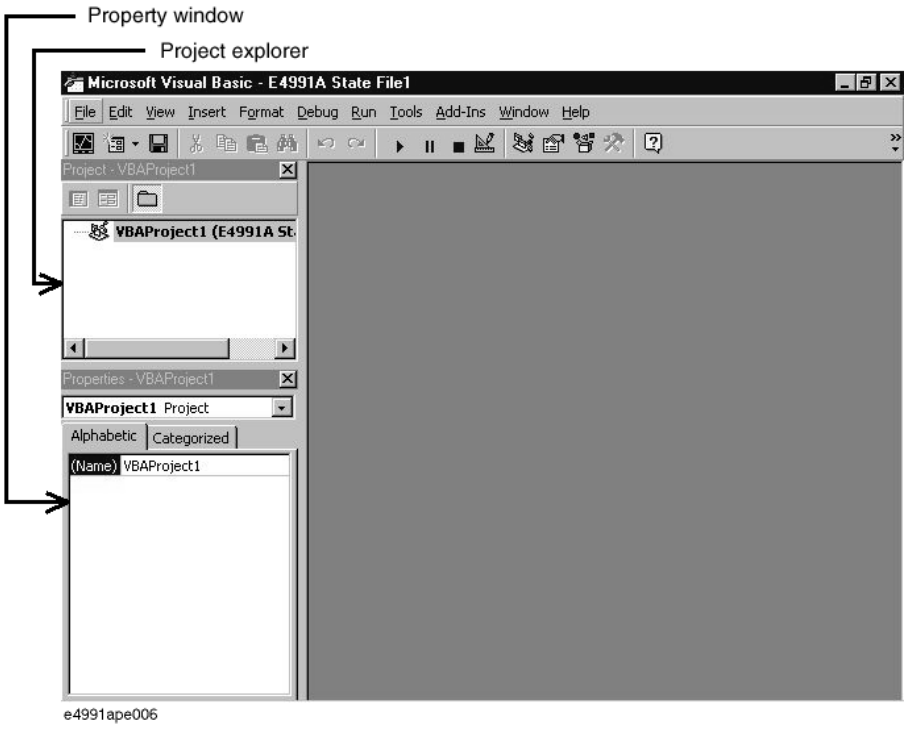
  For example, in order to display the character string (Caption) reading “Measure” on the command button named “Button,” input the following:

  Button.Caption = "Measure"

  For more information on how to prepare various kinds of properties, please refer to the E4991A VBA on-line help.

NOTE The property window is only needed when making macros with the user form.

Figure 13-2 **Editor screen of Visual Basic right after startup**



Other windows

The following windows are not displayed after startup of Visual Basic Editor but are needed for programming. Some of the windows displayed in Visual Basic Editor are not introduced here.

- Form designer

  By using the form designer, you can make your own user forms. When the corresponding macro is executed, the user form will be displayed on the screen. For example, this is useful for inputting data in a text box on the user form or for executing/ending measurement by clicking a command button.

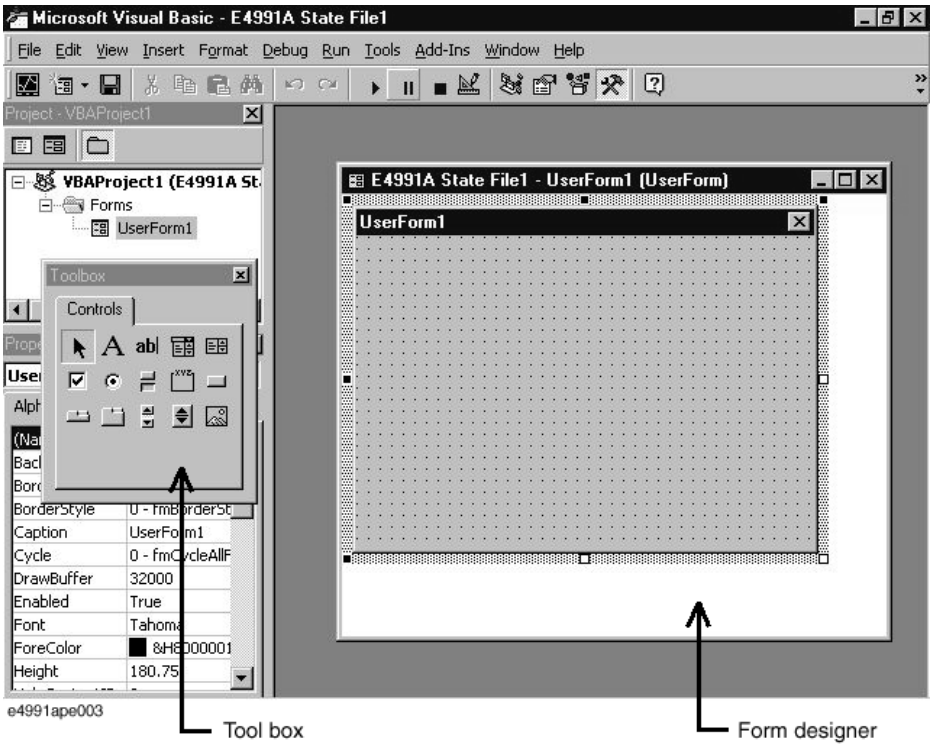
Step 1. The form designer is displayed by the following menu command.

Insert - UserForm

- Toolbox

  When starting up the form designer, the toolbox is displayed. A user form can be made by freely dragging and dropping command buttons or text boxes. For the types and uses of the prepared controls, please refer to E4991A VBA help.

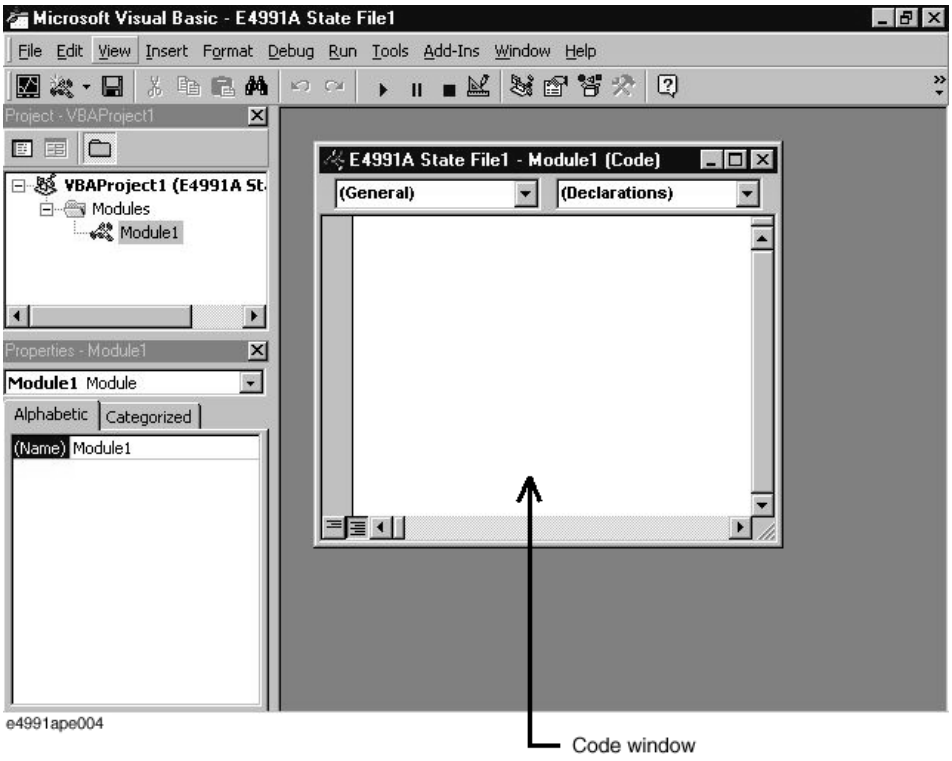
Figure 13-3 Form designer/display screen of tool box



- Code window

  The screen used to input program code is the code window. When adding a module to the project, or by double-clicking the control arranged on the user form, the code window is opened. For explanations of each part of the code window, please refer to “Parts of the code window” on page 226.

Figure 13-4 Display screen of code window



- Object browser

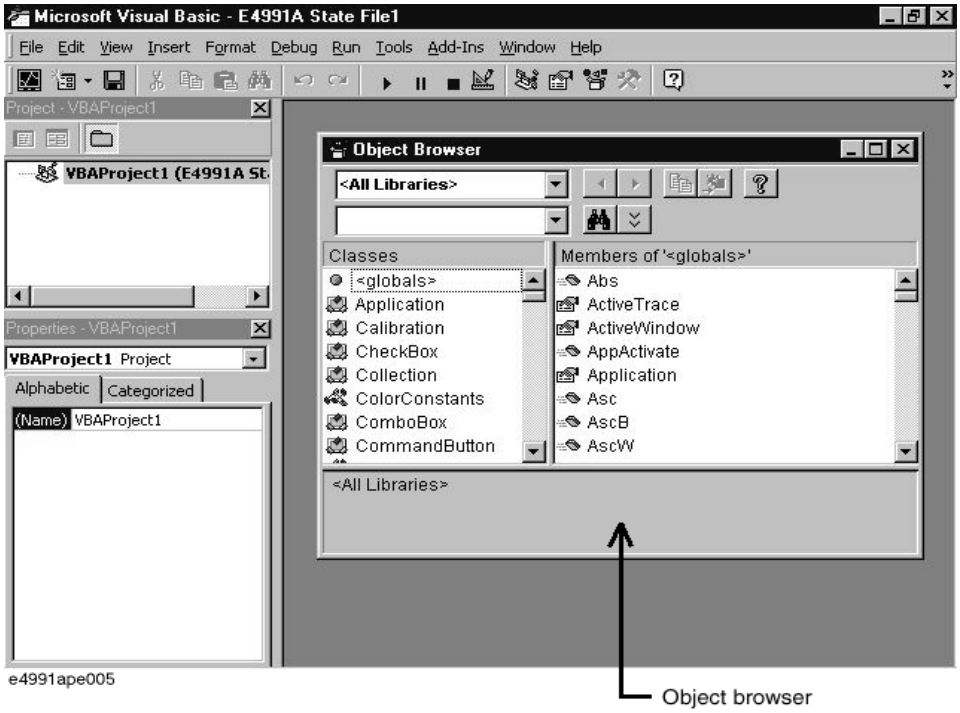
  The object browser provides access to the object and is displayed as follows.

Step 1. T object browser can be displayed by the following menu command.

View - Object Browser

In E4991A, the settings of measurement conditions and the software for calling measurement values are provided in the form of individual objects for each use. Using the object browser, you can refer to the software objects provided by the E4991A (COM Interface). For details, please refer to “E4991A Library” on page 228.

Figure 13-5 Display screen of object browser



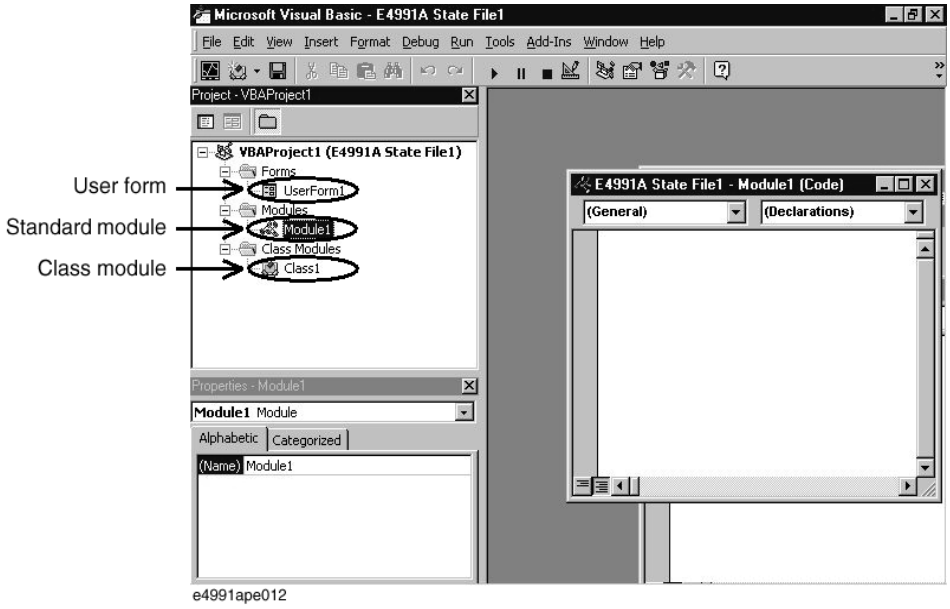
- E4991A VBA help

  While using E4991A VBA, you can learn about unfamiliar operations and keywords by checking the E4991A VBA on-line help. For how to use E4991A VBA help, please refer to “Using E4991A VBA Help” on page 234.

Project and module

In the project explorer, the macro currently used is displayed. Here, the elements of project and module are briefly described.

Figure 13-6 **Example display screen of project explorer**



Project

The element that gathers and manages a micro's module group is called a project. With the E4991A, it is impossible to distinguish and use multiple projects within the project explorer. Therefore, it is necessary to either load a new project into the macro under construction or to insert an existing project into a saved macro. For how to load a macro, please refer to "Loading macros" on page 233.

Module

You can make a macro by describing code in a module. In the E4991A, the following three types of modules can be used. Each type has its own characteristics as shown below.

- Standard module

  Standard module has nothing to do with the user form and is a program composed of less than one procedure (this program is composed of "Sub" to "End Sub"). The extension "*.bas" is attached to a standard module.

Step 1. Standard module is added to a project by the following menu command.

Insert - Module

- User form

  The program (procedure) is shown on the control pasted on the user form. The extension “*.frm” is attached to a user form.

Step 1. User form is added to a project by the following menu command.

Insert - **UserForm**

After the user form is added, the code window describing its code is not displayed but can be viewed double-clicking on the appropriate control on the user form.

- Class module

  Class module is used to make an object in Visual Basic that can be used from another application. This class is actually a template for making an object for Visual Basic. The extension “*.cls” is attached to a class module.

Step 1. Class module is added to a project by the following menu command.

Insert - **ClassModule**

Exporting modules

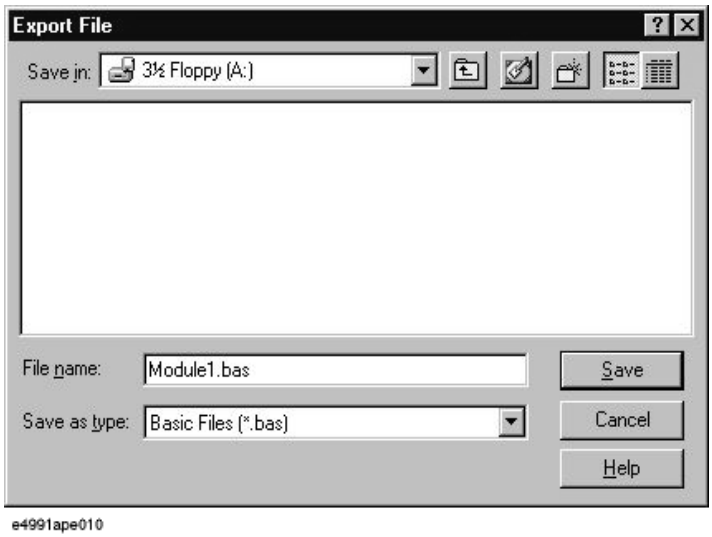
Saving the created modules individually in folders is called exporting. A module is exported by following the procedure below.

NOTE When you export a module, the designated module is saved in a folder but not in the project unit. For how to save a macro in the project unit, please refer to “Saving macros” on page 232.

Step 1. In the project explorer, right-click on the module you want to export, which will display the shortcut menu.

Step 2. Click **Export File...** in the shortcut menu to display the Export File dialogue box.

Figure 13-7 Example display screen of Export File dialogue box



Step 3. Click the **Save** button to export the module to the designated folder.

Each part in the Export File dialogue box is explained as follows.

Save In:	Designate the folder where you want the exported module to reside.
File Name:	Input the filename of the exported module.
Save as Type:	Select the type of module. When the module you want to export is selected, its corresponding type is displayed, so this setting should be left as it is.
Save	Export the designated module.
Cancel	Return to the original screen without exporting a module.
Help	Display the E4991A VBA help screen.

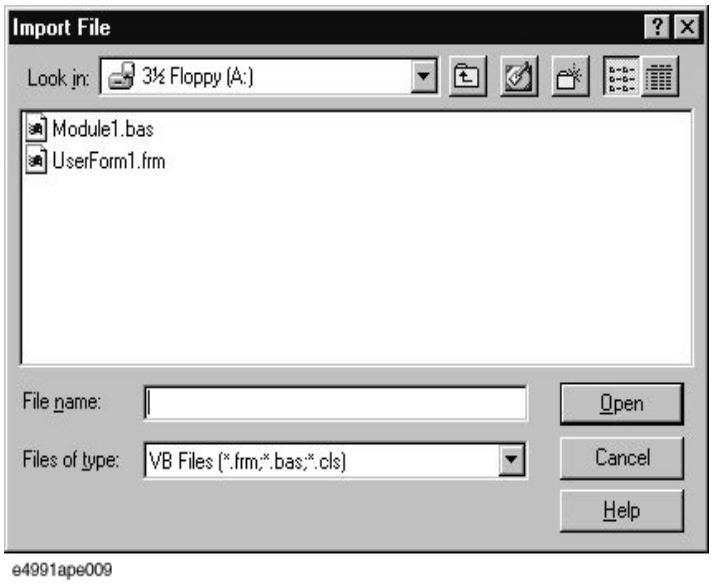
Importing modules

Calling an exported module and inserting it into project is called importing. A module is imported by following the procedure below.

Step 1. Display the Import File dialogue box by the following menu command.

File - Import File...

Figure 13-8 **Example display screen of Import File dialogue box**



Step 2. In the Import File dialogue box, select the file to import. Next, click the **Open** button to import the file into the project.

Each part of the Import File dialogue box is explained as follows.

Look In:	Designate the folder where the module is saved.
File Name:	Input the filename of the module to save.
Files of type:	Select the type of module to import. You can designate any type of module.
Open	Import the module into the project.
Cancel	Return to the original screen without importing a module.
Help	Display the E4991A VBA help screen.

Removing modules

The procedure for removing unnecessary modules from a macro is explained below. In the following example, a standard module called “Module1” is removed.

Step 1. In the project explorer, right-click the “Modulel” module under the “Modules” icons to display the shortcut menu.

Step 2. Next, click **Remove Module1** in the shortcut menu.

Step 3. When the next dialog box asks you if you want to export module1 before removing it, click the **No** button.

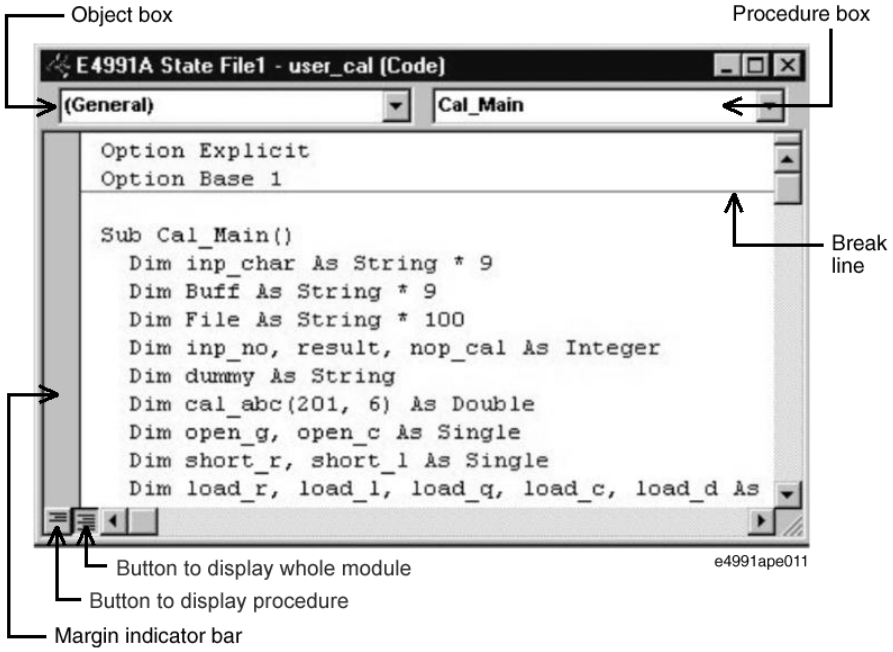
Describing macros

The following explains each part of the code window used in making macros and how to describes programs.

Parts of the code window

You describe macros in the code window. Double-click on any module from the property explorer to open the code window.

Figure 13-9 **Example display screen of code window**



- Object box

  In this list box select the object that you want to display in the code window.

- Procedure box

  In this list box select the procedure that you want to display in the code window.

- Break line

  Used to insert breaks between parts of a macro.

- Margin indicator bar

  Mainly use in debugging.

Structure of macro

Each part of a macro is explained by using the following example of a simple macro. The parts of the program are indicated by the numbers to the right in parentheses (these numbers are not used in the actual program).

Example 13-1 **Example of macro program**

```
Sub Sample1() (1)

 ' Sample Program 1 (2)

 Dim i As Integer (3)
 Dim total As Integer (3)

 total = 0
 For i = 1 To 10 Step 1 (4)
   total = total + i (5)
 Next i (4)

 MsgBox ("Total = " & Val(total)) (6)

End Sub
```

Each part of the above macro is explained as follows.

1. The macro starts with the form of “Sub Sample1()” and ends with “End Sub”. This group is called the procedure. Here, “Sample1” is a procedure name.
2. Everything written to the right of the comment symbol (') is a comment.
3. The type of parameter is declared by a Dim statement. Here, a command is called a statement. In the program example, the variables of “i” and “total” are declared by the type of integer. For more on statements prepared by E4991A VBA and the types of parameters handled in E4991A VBA, please refer to E4991A VBA help.
4. By using a For...Next statement, a loop is executed a fixed number of times.
5. “total” plus “i” equals “Total”. Here, since “i” is used as the fixed number of times in a For...Next statement, the numeric values from 1 to 10 are added to “total” in order.
6. The result of the calculations can be displayed by using the message box function. For more on the functions provided with E4991A VBA, please refer to E4991A VBA help.

NOTE In Example 13-1, only a single procedure is explained as an example. The larger a macro gets, the more care needs to be taken in programming, such as when selecting the declaring method for dealing with a parameter between multiple procedures.

E4991A Library

The COM Interface is provided to control the E4991A. In Visual Basic Editor, you can see a list of COM Interfaces that work with the E4991A by opening the object browser while programming. This also displays the VBA Syntax and a simple explanation of the E4991A COM Interface. Since explanations of the E4991A COM Interface are not included in E4991A VBA help, please refer to Chapter 18, “COM Interface Reference,” on page 527.

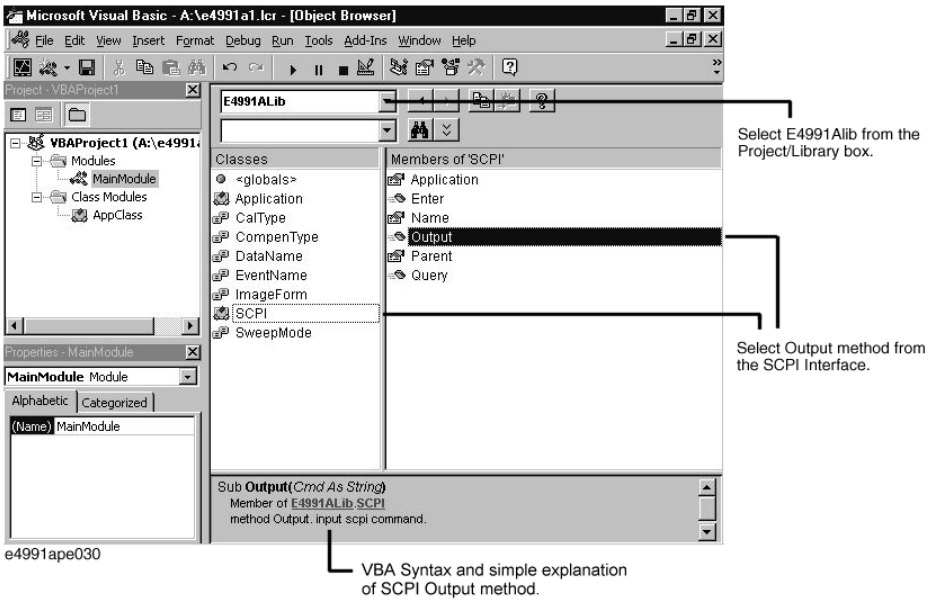
Step 1. Display the object browser by the following menu command.

View - Object Browser

Step 2. Next, select E4991Alib from the Project/Library box to display the E4991A Library.

Step 3. Select the COM Interface that you need. Then, the corresponding E4991A VBA Syntax and a simple explanation of the selected COM Interface are displayed in the bottom part of the window.

Figure 13-10 Example of using Object browser



Macro recording

In VBA, Microsoft Excel supports macro record*1, but the E4991A VBA does not. Therefore, you cannot use this function to record a sequence of front panel key, keyboard, and mouse operations as a macro for later use.

*1. Function to automatically convert performed operations into a macro by recording them.

Debugging macros

In order to eliminate disruptive errors (bugs) from macros, the operation of debugging is necessary. E4991A VBA has a tool that can search for bugs and resolve such situations.

Types of bugs and debugging

The following types of bugs are the most common.

- Syntax error (compile error)

  A syntax error occurs by inputting a statement that violates the grammar rules of Visual Basic. For example, an error in spelling is a syntax error. E4991A VBA shows error messages in the error dialogue box and indicates the origin of an error in red. To better understand the details of an error, click the **HELP** button in the error dialogue box. A macro cannot be executed until any syntax error is resolved.

  In the initial settings, the function that automatically searches for syntax errors is activated. However, you can freely turn on/off the automatic syntax error checking function.

Step 1. In Visual Basic Editor, turn on/off the automatic syntax error checking function by the following menu command.

Tools - **Options...** - **Auto Syntax Check**

- Execution error

  Such errors occur while executing a macro. This type of error normally interrupts the program or ends it at unexpected places. If the program is interrupted, it can be stopped by clicking the **END** button in the error dialogue box. In addition, if the **DEBUG** button is available in the error dialogue box, you can click it to specify the cause of the error. After doing this, the error is highlighted in yellow.

- Logic error

  A logic error is a type of human error. For example, programming to control the E4991A might stipulate that dc bias be applied and measured. However, if dc bias is not applied, the expected measurement will not be complete, even though you can execute the macro without any problem. Since E4991A VBA does not return an error in this case, the programmer must specify the cause of the error himself. In order to find the logic error, break points must be set up in suspected places, and the performance is confirmed through stepwise execution of statement performance. E4991A VBA has a debug tool for this purpose. For more on how to use the debug tool, please refer to E4991A VBA help.

Step 1. In Visual Basic Editor, you can display the debug tool by the following menu command.

View - **Tool bars** - **Debug**

Executing and Terminating Macros

Executing macros

With the E4991A, macros can be executed in the following four ways.

Executing macros from Visual Basic Editor

Step 1. You can display the Macros dialogue box by using either of the following methods.

- Type the **[F5]** key from the keyboard.
- Use the **Run** - **Run** menu command in Visual Basic Editor.

Step 2. In the Macros dialogue box, execute the selected macro (procedure). For how to do this operation, please refer to “Display screen right after execution of a macro” on page 231.

Executing macros from the E4991A measurement screen

Step 1. From the measurement screen of the E4991A, display the Macros dialogue box by the following menu command.

Utility - VBA Macros...

Step 2. In the Macros dialogue box, execute the selected macro (procedure). For how to do this operation, please refer to “Display screen right after execution of a macro” on page 231.

Automatically executing macros during power-up

If a macro meets the following conditions in the “D:\” folder at the time of power-up of the E4991A, the macro (“Start” procedure) is executed automatically.

Macro to be executed	Condition
The folder name where macro is placed	D:\
Name of macro	Autost.lcr
Name of module	Pon
Name of procedure	Start

Executing macros by GPIB commands

You can execute a macro by using a GPIB command.

First, specify the macro to be executed by using the following GPIB command.

- **PROG:NAME** on page 394

By continuously using the following GPIB command, execute the macro.

- **PROG:STAT** on page 395

Display screen right after execution of a macro

When you execute a macro, the Macros dialogue box first opens. Specify the macro to be executed in this box. Each part of the Macros dialogue box is explained as follows.

Macro name:	Select the macro (procedure) to be executed from the list box.
Macro in:	Specify the folder where the macro is saved.
Run	Execute the selected macro (procedure).
Cancel	Return to the original screen without executing a macro.
Step into	After the Visual Basic Editor screen is displayed, execute the selected macro line-by-line (step into). This is mainly done when you want to confirm the performance of a macro.
Edit	Use to re-edit the selected macro.
Create	Normally, this button is not available.
Delete	Delete the selected macro.

Terminating macros

Stopping macros

The following procedure explains how to stop macros during execution.

Step 1. Stop a macro by either of the following methods.

- Type **[Ctrl]** and **[Break]** at the same time from the keyboard.
- Use the **Run** - **Break** menu command in Visual Basic Editor.

Abruptly terminating macros

The following procedure explains how to abruptly terminate macros.

Step 1. Terminate a macro abruptly by either of the following methods.

- Use *End statement* in the code.
- Use the **Run** - **Reset** menu command in Visual Basic Editor.

Saving/Loading Macros

The following explains how to save and load macros in the project unit.

Saving macros

A macros is saved in a filename with the extension (*.lcr).

Saving from Visual Basic Editor

A macro that has been made or edited is saved by the following procedure.

Step 1. Display the Save As dialogue box from the Visual Basic Editor by the using the following menu command.

File - **Save xxxx**

The filename is typed in the “xxxx” part.

Step 2. After inputting the filename of a macro and the name of the folder to save it in, click the **Save** button to save the macro.

The following explains each part of the Save As dialogue box.

Save In:	Specify the folder to save the macro in.
File Name:	Input the name of the macro file.
Save as Type:	Select the type of file. Normally, “E4991A Program File [*.lcr]” is selected.
Save	Save the macro into the designated folder.
Cancel	Close the Save As dialogue box and return to the original screen without saving a macro.

Saving from the E4991A measurement screen

The following procedure can be used to save the macro from the measurement screen of the E4991A.

Step 1. Display the Save Program dialogue box from the measurement screen of the E4991A by using the following menu command.

Utility - **Save Program**

Step 2. After inputting the filename of the macro and the name of the folder to save it in, click the **OK** button to save the macro.

Each part of the Save Program dialogue box is explained as follows.

Drive:	Specify the folder to save the macro in.
File Name:	Input the filename of the macro.
OK	Save the macro into the designated folder.
Cancel	Close the Save Program dialogue box without saving a macro.
New Folder	Make a new folder.
Delete	Delete the specified file.
Copy to FDD	Copy the macro onto a floppy desk.
Key board...	Input filenames, etc. by using the mouse with the keyboard displayed on the screen.

Loading macros

The following procedure can be used to load a saved macro.

Step 1. Display the Load Program dialogue box from the measurement screen of the E4991A by using the following menu command.

Utility - **Load Program**

Step 2. After inputting the filename of the macro and the name of the folder name to save it in, click the **OK** button to load the macro.

Each part of the Load Program dialogue box is explained as follows.

Drive:	Specify the folder to save the macro in.
File Name:	Input the filename of the macro.
OK	Load the macro.
Cancel	Close the Load Program dialogue box without loading a macro.
New Folder	Make a new folder.
Delete	Delete the specified file.
Copy to FDD	Copy the macro onto a floppy desk.
Key board...	Input filename, etc.by using the mouse with the keyboard displayed on the screen.

Using E4991A VBA Help

If you don't know how to use a particular operation of E4991A VBA, you can find more on the topic in the E4991A VBA help (Visual Basic Reference).

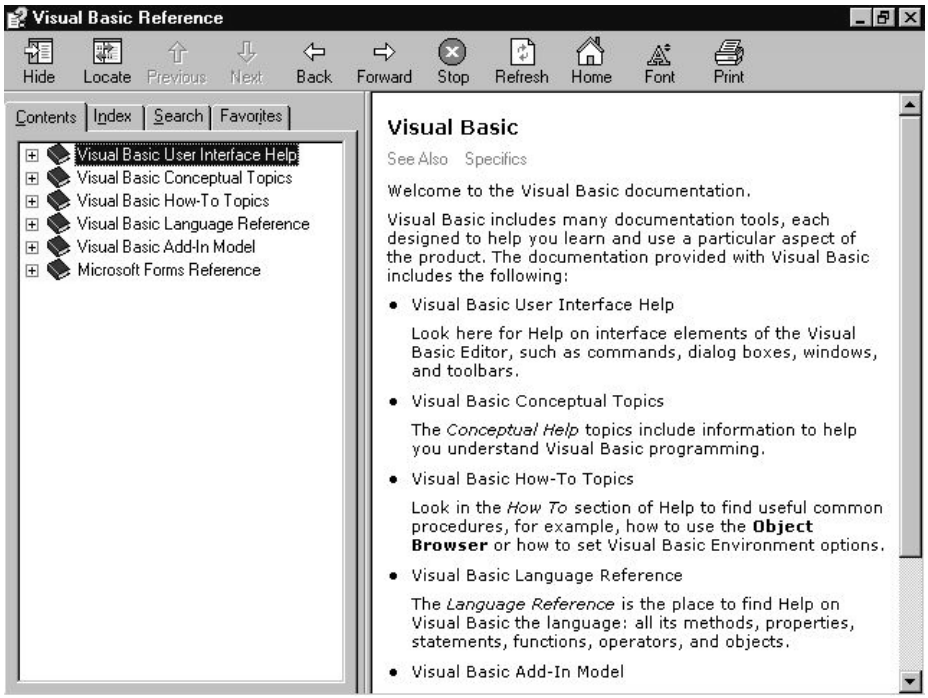
Displaying the E4991A VBA help screen

Step 1. The E4991A VBA help screen is displayed from Visual Basic Editor by using the following menu command.

Help - Microsoft Visual Basic Help

You can also display the E4991A VBA help screen by typing **[F1]** from the keyboard.

Figure 13-11 E4991A VBA help display screen


Visual Basic Reference
Hide
Locate
Previous
Next
Back
Forward
Stop
Refresh
Home
Font
Print
Contents
Index
Search
Favorites
Visual Basic User Interface Help
Visual Basic Conceptual Topics
Visual Basic How-To Topics
Visual Basic Language Reference
Visual Basic Add-In Model
Microsoft Forms Reference
Visual Basic
See Also
Specifics
Welcome to the Visual Basic documentation.
Visual Basic includes many documentation tools, each designed to help you learn and use a particular aspect of the product. The documentation provided with Visual Basic includes the following:
Visual Basic User Interface Help
Look here for Help on interface elements of the Visual Basic Editor, such as commands, dialog boxes, windows, and toolbars.
Visual Basic Conceptual Topics
The Conceptual Help topics include information to help you understand Visual Basic programming.
Visual Basic How-To Topics
Look in the How To section of Help to find useful common procedures, for example, how to use the Object Browser or how to set Visual Basic Environment options.
Visual Basic Language Reference
The Language Reference is the place to find Help on Visual Basic the language: all its methods, properties, statements, functions, operators, and objects.
Visual Basic Add-In Model
e4991ape008

Displaying topics of E4991A VBA

Each topic in E4991A VBA help is organized within a hierarchical structure. Double-click items to display their contents in the window pane to the right of the topic list. In addition, E4991A VBA has the following help tools.

- Visual Basic User Interface Help
- Visual Basic Conceptual Topics
- Visual Basic How-To Topics
- Visual Basic Add-In Model
- Microsoft Forms Reference

If you don’t understand how to use Visual Basic Editor, you should initially refer to User Interface Help and How-To Topics.

Referring to contents of keywords

A macro is prepared for the statement called keywords. For example, the words “Sub” and “With” are applied to such statements. If you don’t understand how to a the keyword, move the cursor over the it while continuously holding the **[F1]** key on the keyboard. This will quickly display the E4991A VBA help related to the keyword. In addition, many keywords are displayed in blue within the Visual Basic Editor.

14 Outline of Programming Using COM

This chapter gives the required information for programming with the COM interface of the Agilent E4991A. For more basic information on the COM interface, refer to Chapter 18, “COM Interface Reference.”

Outline of E4991A COM

COM is the abbreviation of “Component Object Model.” The following gives a simplified concept of COM and describes the COM interface specifications.

NOTE The company shall not guarantee the operation of the E4991A COM on any application software other than E4991A VBA (Visual Basic for Application).

E4991A COM Object

The parts of the E4991A COM object interface are classified as follows.

Property

The object property is used for reading the status of the E4991A. For example, it is possible to confirm the version of E4991A VBA (Visual BASIC for Application) equipped with the E4991A instrument by using **VBAVersion property** on page 530.

This group includes COM objects indicated by the object name followed by “property.”

Method

With the E4991A, an object method is used for executing a target movement (operation) or realizing a function. For example, it is possible to execute a sweep once by using **SingleMeasure method** on page 532 or to copy the image of a measurement screen onto the clipboard after completing measurement by using **GetScreenImage method** on page 535.

This group includes COM objects indicated by the object name followed by “method.”

Event

You can confirm the status transitions that occur in the E4991A by detecting the events issued by the object. For example, you can determine the completion of a sweep by using **SweepEnd event** on page 537.

This group includes COM objects indicated by the object name followed by “event.”

Limitations on using the E4991A COM object

When the E4991A cannot be controlled by only using a E4991A COM object, it is necessary to combine the following COM object methods with their corresponding E4991A GPIB commands.

- **Output method** on page 543
- **Enter method** on page 542
- **Query method** on page 543

Comparison of COM objects and GPIB commands

The following table compares the E4991A's COM objects and GPIB commands

Table 14-1 Function comparison of GPIB commands and COM objects

Item	Controls	GPIB command	COM object
Setting measurement conditions/read	Sets measurement conditions.	Dedicated GPIB commands are prepared.	No dedicated COM interface is prepared.
Preparing for accurate measurement (calibration/fixture compensation)	Sets conditions for calibration/fixture compensation and data measurement. Also switches on/off functions after data measurement.	Dedicated GPIB commands are prepared.	No dedicated COM interface is prepared.
	Measures calibration data/fixture compensation data.		Use the following COM interfaces. • **CalMeasure method** on page 533 • **CompenMeasure method** on page 534
	Detects the start/end of calibration data/fixture compensation measurement.	Use the GPIB Status report system.	
Detecting the start of measurement (trigger) and completion of measurement (sweep completion)	Sets trigger to start measurement.	Dedicated GPIB commands are prepared.	No dedicated COM interface is prepared.
	Performs the sweep once.		Use the following COM interface. • **SingleMeasure method** on page 532
	Waits for the end of sweep. (Detects the end of sweep.)	Use the GPIB Status report system.	
	Confirms waiting status for the trigger.		Use the following COM interface. • **WaitForEvent method** on page 536
Reading/writing measurement data	Selects data transfer format.	Dedicated GPIB commands are prepared.	No dedicated COM interface is prepared.
	Reads/writes internal data array.		No dedicated COM interface is prepared. In **Enter method** on page 542, internal data array can be read by specifying how to read the data array.
Processing measurement result	Uses marker function and equivalent circuit analysis function.	Dedicated GPIB commands are prepared.	No dedicated COM interface is prepared.

Table 14-1 Function comparison of GPIB commands and COM objects

Saving/recalling files	Saves measurement parameter of E4991A, measurement results, etc. in files and recall saved contents.		No dedicated COM interface is prepared. When COM object is executed from a Personal Computer that uses remote user interface function, the folder at the Personal Computer side is used to save/recall the files.
Using printer	Outputs measurement results of E4991A to the printer.	Dedicated GPIB commands are prepared.	No dedicated COM interface is prepared. When COM object is executed from a Personal Computer that uses remote user interface function, measurement results, etc. of E4991A are outputted to the printer registered at the Personal Computer side.
	Copies set parameters of E4991A, measurement results, etc. onto the clipboard.	Not prepared.	The following COM interfaces are prepared assuming usage of a Personal Computer that uses remote user interface function. • **GetTextData method** on page 535 • **GetScreenImage method** on page 535
Setting display screen	Sets the display screen.	Dedicated GPIB commands are prepared.	No dedicated COM interface is prepared.
Error processing	Reads errors.	Dedicated GPIB commands are prepared.	No dedicated COM interface is prepared.
	Detects an E4991A measurement failure and processes it.	Use the GPIB Status report system.	Use the following COM interfaces. • **Unlocked event** on page 539 • **DcBiasOverload event** on page 539 • **RfOverload event** on page 540
	Detects an error other than the above type and processes it.		No dedicated COM interface is prepared. By combined execution of COM object and GPIB command, status bit figures specified by each status register of GPIB Status report system can be read, but no processing can be performed during bit transition from 0 to 1 or 1 to 0.

Table 14-1 Function comparison of GPIB commands and COM objects

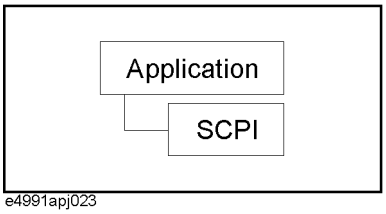
Status report system	Checks the condition of the E4991A	Use the GPIB Status report system.	Use the GPIB Status report system as a rule. *1 Original COM objects are prepared to detect the following events. • **SweepEnd event** on page 537 • **SweepStart event** on page 538 • **CompleteSweepAveraging event** on page 538 • **Unlocked event** on page 539 • **DcBiasOverload event** on page 539 • **RfOverload event** on page 540
System setting	Checks whether remote user interface function and E4991A are connected.	Not prepared.	The following COM interface is prepared assuming the usage of a Personal Computer that uses remote user interface function. • **Connection property** on page 531
	Items other than the above (system-related setting/reading)	Some dedicated GPIB commands are prepared.	No dedicated COM interface is prepared.

*1. However, the SRQ is unavailable, so the procedure for setting the ***SRE** on page 283 is always disabled. Furthermore, a program based on a COM interface cannot handle an interruption by using the SRQ.

E4991A COM Object Model

The following objects are prepared for the E4991A.

Figure 14-1 **E4991A COM Object Model**



Application Object

The application object is positioned at the top of the hierarchical structure of the E4991A COM object model.

Property

Name	Reads the application name “E4991A”.
VBAVersion	Reds the version of the E4991A VBA.
Connection	Reads whether it is connected with the E4991A by using the user interface function.

Method

SingleMeasure	Performs sweep and waits until completion.
CalMeasure	Measures calibration data and waits until completion.
CompenMeasure	Measures fixture compensation data and waits until completion.
GetTextData	Copies setting condition or measured data on the clipboard.
GetScreenImage	Copies screen image to the clipboard.
WaitForEvent	Waits for occurrence of specified event for specified period of time.

Event

SweepEnd	Indicates that the sweep was completed.
SweepStart	Indicates that the sweep has started.
CompleteSweepAveraging	Indicates the completion of the specified number of times of sweep averaging.
Unlocked	Indicates that “PLL Unlock” error was detected in the E4991A.
DcBiasOverLoad	Indicates that “DC bias overload” error was detected in the E4991A.
RfOverLoad	Indicates that “RF overload” error was detected in the E4991A.

SCPI Object

SCPI objects are the group of objects prepared for combined use with the E4991A's GPIB commands.

Property

Name	Reads "SCPI".

Method

Enter	Reads returned value of GPIB command executed by Query.
Output	Executes GPIB command.
Query	Executes GPIB command by Query and reads the response.

E4991A Library

The E4991A library is required when writing programs or executing them on the E4991A or on a personal computer with a remote user interface function using E4991A VBA. The The E4991A library is pre-programmed for browsing through E4991A VBA.

Where to install the E4991A library

The E4991A library is installed in the following location on a personal computer equipped with the E4991A remote user interface function.

Library name:	E4991A x.x Type Library
Location:	C:\Program File\Agilent\E4991A\E4991A.tlb

15 Controlling Peripherals

This chapter explains how to control peripherals connected to the Agilent E4991A by using the software (VISA) installed in the instrument.

Overview

The E4991A macro function (E4991A VBA) can be used not only to automate measurements but also to control external measurement instruments connected via USB/GPIB interface by acting as a self-contained system controller (refer to “Remote control using E4991A macros” on page 32).

This function performs communications via the COM interface when controlling the E4991A itself, but it communicates via VISA (Virtual Instrument Software Architecture) when controlling external measurement instruments.

To control peripherals connected to the E4991A, the following two preparations are required.

Preparation

Importing definition files

To use the VISA library in the E4991A macro (E4991A VBA), you need to import two definition files into your project with the Visual Basic editor to define the VISA functions and perform other tasks. The definition files are stored on the sample programs disk under the following filenames (for information on importing modules, refer to “Importing modules” on page 224).

- visa32.bas
- vpptype.bas

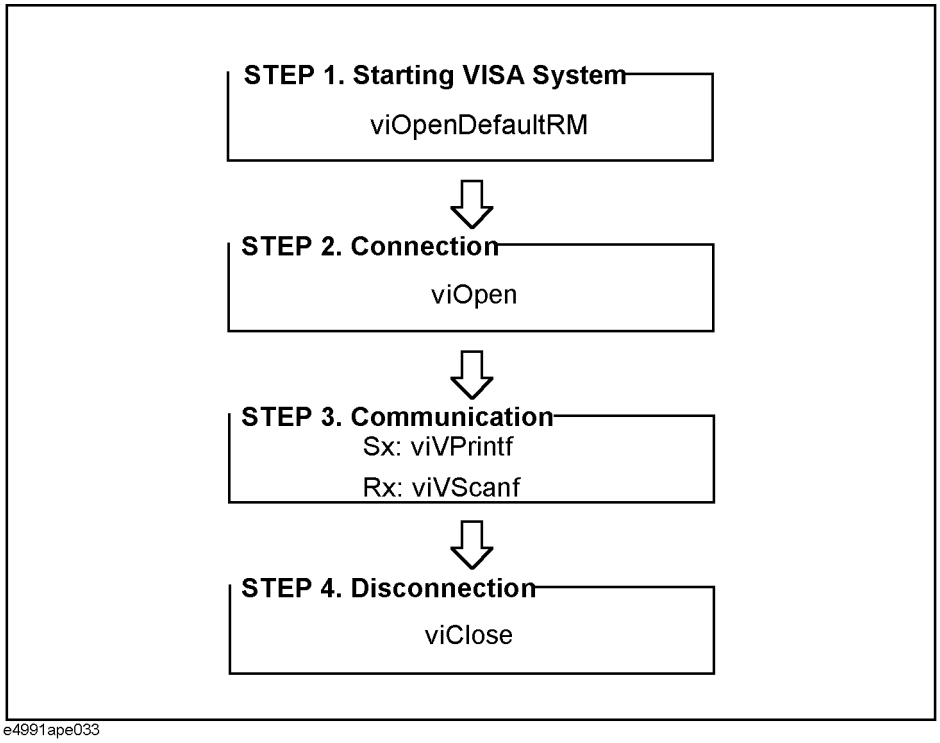
Programming with VISA

Figure 15-1 shows the flow of controlling the instrument with VISA. When developing a VISA program in the Visual Basic language, a special programing notice (in the readme text file listed below) must be reviewed.

For details on the use of the VISA library and the programing notice for using the VISA library with the E4991A macro (E4991A VBA), refer to the following files contained on the CD-ROM (Agilent part number: E4991-905x0).

- visa.hlp (on-line help for the VISA library)
- vbreadme.txt (notes on using the VISA library with VB)

Figure 15-1 Flow of instrument control with VISA



e4991ape033

STEP 1. Starting up VISA system

The VISA system startup session is processed in Lines 150 to 160 in Example 15-1. VISA's viOpenDefaultRM function initializes and starts up the VISA system. The viOpenDefaultRM function must be executed before other VISA functions are called, and the parameter of this function is startup information (Defrm in Example 15-1).

Syntax viOpenDefaultRM(*param*)

Parameter

	(***param***)
Description	Startup information (output)
Data type	Long integer type

STEP 2. Connection

The connection session is handled in Lines 190 to 200 in Example 15-1. VISA's viOpen function makes connection with the specified instrument. The viOpen function returns a value so that the VISA functions can apply it to the specified instrument. The parameters of this function are startup information (Defrm in Example 15-1), the address information of the specified instrument ("GPIB0::5::INSTR" in Example 15-1), access mode (0 in Example 15-1), timeout (0 in Example 15-1), and connection information (Dcps in Example 15-1).

Syntax viOpen(*param1*,*param2*,*param3*,*param4*,*param5*)

Parameters

	(***param1***)
Description	Startup information (input)
Data type	Long integer type

	(***param2***)
Description	Address information of the specified instrument (input)
Data type	Character string type
Syntax	GPIB[*board*]*1::*primary address**2::INSTR

*1. GPIB0 for the E4991A.
*2. The GPIB address of the instrument controlled by the E4991A.

	(***param3***)
Description	Access mode (Enter 0)

	(*param4*)
Description	Timeout (Enter 0)

	(*param5*)
Description	Connection information (output)
Data type	Long integer type

STEP 3. Communication

The communication session is conducted in Lines 230 to 280 and Line 410 in Example 15-1. VISA's viVPrintf function sends a program message (GPIB command) to the specified instrument. The parameters of this function are connection information (Dcps in Example 15-1), the program message (a GPIB command in Example 15-1), and the variable to be formatted (0 in Example 15-1).

NOTE

To input/output GPIB commands, the viVPrintf function and the viVScanf function are mainly used, but other VISA functions are also available. For more information, refer to visa.hlp (online help for the VISA library).

Syntax

viVPrintf(*param1*,*param2*,*param3*)

Parameters

	(*param1*)
Description	Connection information (input)
Data type	Long integer type

	(*param2*)
Description	Program message (input)*1
Data type	Character string type

*1. When sending a program message of the GPIB command, a message terminator is required at the end of the message (Chr$(10) in Example 15-1).

	(*param3*)
Description	A variable to be formatted*1
Data type	Specified data type

*1. If not applicable, enter 0.

The receiving session is controlled in Lines 310 to 320 in Example 15-1. VISA's viVScanf function receives the result from the specified instrument and stores it in the output variable. The parameters of this function are connection information (Dcps in Example 15-1), the format parameter for the output variable (%t in Example 15-1), and the output

variable (Res in Example 15-1).

Syntax viVScanf(*param1*,*param2*,*param3*)

Parameters

	(***param1***)
Description	Connection information (input)
Data type	Long integer type

	(***param2***)
Description	Format parameter for the output variable
Data type	Character string type

	(***param3***)
Description	Output variable (output)
Data type	Character string type

STEP 4. Disconnection

The disconnection session is handled in Lines 190 to 200 in Example 15-1. VISA's viClose function disconnects communication and terminates the VISA system. The parameter of this function is startup information (Defrm in Example 15-1).

Syntax viClose(*param*)

Parameter

	(***param***)
Description	Startup information (input)
Data type	Long integer type

Application program using DC power supply (Agilent E3631A)

The sample program shown below controls the DC power supply (Agilent E3631A) connected via GPIB while using the E4991A as the system controller. This program is stored on the sample program disk. Its filename is ext_cont.bas.

NOTE

When controlling the DC power supply (Agilent E3631A) from the E4991A macro (E4991A VBA), VISA is used for communication of the GPIB commands supplied with the DC power supply (Agilent E3631A). On the other hand, when controlling the E4991A itself from the E4991A macro (E4991A VBA), the COM interface provided with the E4991A is used for communication (Lines 120 and 380 in Example 15-1).

Line 100	Assigns settings for the DC power supply output current to a variable.
Line 120	Sets the trigger source of the E4991A to the GPIB trigger via the COM interface.
Lines 150 to 160	Initializes and starts up the VISA system and outputs the startup information to the Defrm variable.
Lines 190 to 200	Establishes the connection to the DC power source (GPIB address: 5) and outputs the connection information to the Dcsp variable.
Lines 230 to 280	Via VISA, sets the DC power supply output current (0.1 A) and queries the output voltage value at that time.
Lines 310 to 350	Via VISA, reads out the DC power supply output voltage value and outputs it to the Res variable. Displays the read-out result in the message box.
Line 380	Via the COM interface, executes a single sweep to the E4991A and waits for the completion of the sweep.
Line 410	Via VISA, turns off the DC power supply output.
Line 440	Disconnects communication and terminates the VISA system.
Lines 480 to 520	If an error occurs in a VISA function, forces termination of the program.

Example 15-1 **Sample program using a DC power supply**

```
  10|
  20|  Sub main()
  30|
  40|      Dim status As Long          'VISA function status return
code
  50|      Dim Defrm As Long           'Session to Default Resource
Manager
  60|      Dim Dcsp As Long             'Session to instrument
  70|      Dim Cur As Double            'Single to set current level
  80|      Dim Res As String * 100      'String to hold results
  90|
 100|      Cur = 0.1
 110|
 120|      SCPI.Output "TRIG:SOUR BUS"
 130|
 140|      ' Initializes the VISA system.
 150|      status = viOpenDefaultRM(Defrm)
 160|      If (status <> VI_SUCCESS) Then GoTo VisaErrorHandler
```

```
 170|
 180|      ' Opens the session to the specified instrument.
 190|      status = viOpen(Defrm, "GPIB0::5::INSTR", 0, 0, Dcsp)
 200|      If (status <> VI_SUCCESS) Then GoTo VisaErrorHandler
 210|
 220|      ' Asks for the instrument to turn the dc power on.
 230|      status = viVPrintf(Dcsp, "INST P6V" & Chr$(10), 0)
 240|      status = viVPrintf(Dcsp, "VOLT MAX" & Chr$(10), 0)
 250|      status = viVPrintf(Dcsp, "CURR %lf" & Chr$(10), Cur)
 260|      status = viVPrintf(Dcsp, "OUTP ON" & Chr$(10), 0)
 270|      status = viVPrintf(Dcsp, "MEAS?" & Chr$(10), 0)
 280|      If (status <> VI_SUCCESS) Then GoTo VisaErrorHandler
 290|
 300|      ' Reads the result.
 310|      status = viVScanf(Dcsp, "%t", Res)
 320|      If (status <> VI_SUCCESS) Then GoTo VisaErrorHandler
 330|
 340|      ' Displays the result.
 350|      MsgBox "Result is: " & Res
 360|
 370|      ' Performs a single measure.
 380|      SingleMeasure
 390|
 400|      ' Turns the dc power off.
 410|      status = viVPrintf(Dcsp, "OUTP OFF" & Chr$(10), 0)
 420|
 430|      ' Closes the resource manager session (which closes
everything)
 440|      Call viClose(Defrm)
 450|
 460|      GoTo Prog_end
 470|
 480|  VisaErrorHandler:
 490|      Dim VisaErr As String * 200
 500|      Call viStatusDesc(Defrm, status, VisaErr)
 510|      MsgBox "Error : " & VisaErr, vbExclamation
 520|      End
 530|
 540|  Prog_end: End Sub
```

16 Application Programs

This chapter gives measurement examples (sample programs) using the HTBasic program and the instrument's macro program (E4991A VBA).

Basic Measurement

This application program performs a measurement similar to that of the “Basic operation of RF device measurement” in the E4991A *Installation and Quick Start Guide*.

HTBasic example program

Example 16-1 shows a basic measurement program example (HTBasic) to find the self-resonance point of an inductor. This program is saved under the file name bsc_meas.htb on the sample programs disk. When the program is executed, “Do all the preparations for a measurement.” is displayed. Then connect the equipment in accordance with Chapter 3 “Step 1, Preparations for measurement” in the Installation/Quick Start Guide and start measurement by pushing the **[y]** key or the **[Enter]** key.

When the calibration function is set on, “Do you perform a calibration again?” is displayed. Push any key other than the **[y]** key or the **[Enter]** key to skip calibration. Next, “Connect OPEN Standard to the DUT port.” will be displayed. Then, after connecting the OPEN standard, push the **[y]** key or the **[Enter]** key and measure the open calibration data. In the same way, measure Short/Load/Low-loss capacitor calibration data. However, low-loss capacitor calibration should only be performed as necessary.

Next, “Connect the FXT16197A text fixture to the E4991A” is displayed, and after connecting the 16197A, push the **[y]** key or the **[Enter]** key. Then, “Connect OPEN Standard to electrode plate on the fixture.” is displayed, and after opening the test fixture sample connection screen, push the **[y]** key or the **[Enter]** key to measure open compensation data. In the same way, measure short compensation data.

Next, “Connect the DUT to electrode plate on the fixture.” is displayed. After connecting the chip inductor to the text fixture, pushing the **[y]** key or the **[Enter]** key will execute one sweep, and the marker will search for a self-resonance point; as a result, the frequency and impedance of that point will be displayed. After the measurement result is indicated, “Performing a measurement again? [Y/N]” is displayed. When measuring again or measuring another sample of the same size, push the **[y]** key or the **[Enter]** key to continue the measurement. To finish measurement, push any key other than the **[y]** or the **[Enter]** key.

Line 220	Sets the GPIB address
Lines 240 - 280	Substitutes a variable for the sweep condition. Sets the number of points (201), sweep parameter (frequency sweep type is logarithmic), sweep start value (1 MHz), sweep stop value (3 GHz), and electric current level of the source (1 mA).
Lines 290 - 350	Substitutes variables for the measurement parameter and display method. Sets the parameters for trace 1 (|Z|), trace 2 (Ls), and trace 3 (Q), the display formats for trace 1 (log), trace 2 (linear), and trace 3 (linear), and the display method (displays all traces superimposed in one window).
Lines 360 - 380	Substitutes variables for the setting conditions for calibration and fixture compensation, as well as for the marker function. Sets the calibration/fixture compensation data measurement point (fixed frequency point/fixed power point), test fixture used (16197A), and marker search function (to detect the maximum value).
Lines 400 - 410	Prompts preparation for measurement and waits for input of the **[y]**

	key after completion of preparation. If any other key is input, the program is aborted. The subprogram FNMessage is explained later.
Lines 490 - 510	Returns the E4991A to the default status.
Lines 550 - 610	Sets the sweep conditions. In addition, sets the trigger source to the GPIB trigger.
Lines 650 - 740	Display traces 1, 2, and 3, and sets the measurement parameter and display format for each trace. In addition, the three traces are superimposed and displayed in one window.
Lines 800 - 850	Confirms that the calibration function is set on and, if it is set on, prompts whether to carry out another calibration. If any key other than the **[y]** key is input, the calibration is skipped.
Lines 890 - 900	Sets the calibration kit to the attached 7-mm calibration kit and sets the calibration data measurement point to the fixed frequency point/fixed power point.
Lines 940 - 1010	Measures open/short/load calibration data. Refer to “Example program for execution of calibration” on page 78 for details on the subprogram FNCal.
Lines 1030 - 1070	Waits for the input on whether to execute low-loss capacitor calibration. If the **[y]** key is entered, low-loss capacitor calibration data is measured. If any other key is entered, low-loss capacitor calibration is skipped.
Lines 1090 - 1130	A calibration coefficient is calculated based on the calibration data obtained, and calibration is enabled.
Lines 1220 - 1260	Prompts the connection of the 16197A test fixture and waits for input of the **[y]** key after connection. If any other key is entered, the program is aborted. Next, sets the test fixture to be used to the 16197A.
Line 1340	Sets the fixture compensation data measurement point to the fixed frequency point/fixed power point.
Lines 1380 - 1420	Measures the open/short compensation data. Refer to “Example program for execution of fixture compensation” on page 97 for details on the subprogram FNFixt_comp.
Lines 1440 - 1480	Calculates the compensation coefficient based on the fixture compensation data obtained, and fixture compensation is enabled.
Lines 1550 - 1560	Prompts connection of the sample to the electrode of the test fixture and waits for input of the **[y]** key after connection. If any other key is entered, the program is aborted.
Lines 1640	Clears the status byte register and the operation status event register.
Lines 1650 - 1660	If the operation status condition register bit 4 transits from 1 to 0 (negative transit), the operation status event register bit 4 is set to 1.
Lines 1670 - 1680	Sets the operation status event register bit 4 and the status byte register bit 7 to be enabled.
Lines 1690 - 1700	Sets the branch on which the SRQ interrupts and sets the SRQ interruption to be enabled.
Lines 1720 - 1750	Triggers and executes a sweep once and then waits for completion of the sweep.

Line 1760	Cancels the event start branch of the SRQ interruption.
Lines 1810 - 1830	Executes the auto-scale adjustment for traces 1, 2, and 3, and sets it to the optimum scale.
Lines 1870 - 1900	Sets On marker 1 for trace 1. After specifying marker 1 as an active marker, searches for the maximum value (self-resonance point) using the marker search function.
Lines 1940 - 1970	Reads out the stimulus value (frequency) and the measurement value (impedance) for trace 1.
Lines 2010 - 2040	Shows the read-out measurement results on the display.
Lines 2060 - 2100	Prompts input on whether aa measurement will be performed again or whether another sample of the same size will be measured. If the **[y]** key is input, returns to the sample connection part. If any other key is entered, the program is terminated.
Lines 2180 - 2640	Refer to “Example program for execution of calibration” on page 78 for details on the subprogram FNCal.
Lines 2670 - 3080	Refer to “Example program for execution of fixture compensation” on page 97 for details on the subprogram FNFixt_comp.
Lines 3120 - 3240	Displays the message specified by the variable Mes$ and waits for the input of **[y]** or **[n]**. If the **[y]** key is entered, the return value of the function program is returned as 0. If the **[n]** key is entered, the return value of the function program is returned as -1. If any other key than these is pushed, the program returns to the first input line.

Example 16-1 **Measuring the self-resonant point of an inductor**

```
10
!****************************************************************
20    !* E4991A + 16197A Impedance Measurement (Using Chip Inductor)
30    !* HTBasic Sample Program
40
!****************************************************************
50    !
60
!################################################################
70    !  STEP1: Preparation for a Measurement
80
!################################################################
90    !
100   DIM Inp_char$[9],Buff$[9]
110   DIM Swp_type$[11]
120   DIM Para_a$[5],Para_b$[5],Para_c$[5]
130   DIM Fmt_a$[11],Fmt_b$[11],Fmt_c$[11],Display$[11]
140   DIM Cal_type$[11],Fixture$[11]
150   DIM Mkr_src$[9]
160   REAL Curr_lev,Start,Stop
170   REAL Freq_val,Imp_val
180   INTEGER Corr,Nop,Reply,Result
190   !
200   CLEAR SCREEN
210   !
220   ASSIGN @Agte4991a TO 717
230   !
240   Nop=201                !           Number of Points: 201
250   Swp_type$="LOG"        ! Type of Sweep Mode(X-axis):
LOGARITHMIC
260   Start=1.0E+6           !            Start Frequency: 1.0 MHz
270   Stop=3.0E+9            !             Stop Frequency: 3.0 GHz
280   Curr_lev=1.0E-3        !       Source Current Level: 1 mA
290   Para_a$="Z"            !    Measurement/     Trace1: |Z|
300   Para_b$="LS"           !      Parameters     Trace2: Ls
310   Para_c$="Q"            !                     Trace3: Q
320   Fmt_a$="LOG"          !    Display/        Trace1: LOGARITHMIC
330   Fmt_b$="LIN"           !      Format(Y-axis) Trace2: LINEAR
340   Fmt_c$="LIN"           !                     Trace3: LINEAR
350   Display$="OVER"        !      Display Split/Overlay: OVERLAY
360   Cal_type$="FIX"        !           Calibration Type: FIXED
370   Fixture$="FXT16197A"   !               Test Fixture: 16197A
380   Mkr_src$="MAX"         !  Specified Search Function: MAXIMUM
390   !
400   Reply=FNMessage(@Agte4991a,"Do all the preparations for a
measurement.")
410   IF Reply<>0 THEN Prog_int
420   !
430
!################################################################
440   !  STEP2: Specifying Measurement Conditions
450
!################################################################
460   !
470   !  -> Reset the E4991A to default state
```

```
480   !
490   OUTPUT @Agte4991a;"SYST:PRES"
500   OUTPUT @Agte4991a;"*OPC?"
510   ENTER @Agte4991a;Buff$
520   !
530   !  -> Specifying Sweep Conditions
540   !
550   OUTPUT @Agte4991a;"SWE:POIN ";Nop
560   OUTPUT @Agte4991a;"SWE:TYPE "&Swp_type$
570   OUTPUT @Agte4991a;"FREQ:STAR ";Start
580   OUTPUT @Agte4991a;"FREQ:STOP ";Stop
590   OUTPUT @Agte4991a;"SOUR:CURR:MODE FIX"
600   OUTPUT @Agte4991a;"SOUR:CURR ";Curr_lev
610   OUTPUT @Agte4991a;"TRIG:SOUR BUS"
620   !
630   !  -> Specifying Measurement Parameters
640   !
650   OUTPUT @Agte4991a;"DISP:TRAC1 ON"
660   OUTPUT @Agte4991a;"DISP:TRAC2 ON"
670   OUTPUT @Agte4991a;"DISP:TRAC3 ON"
680   OUTPUT @Agte4991a;"CALC1:FORM "&Para_a$
690   OUTPUT @Agte4991a;"CALC2:FORM "&Para_b$
700   OUTPUT @Agte4991a;"CALC3:FORM "&Para_c$
710   OUTPUT @Agte4991a;"DISP:TRAC1:Y:SPAC "&Fmt_a$
720   OUTPUT @Agte4991a;"DISP:TRAC2:Y:SPAC "&Fmt_b$
730   OUTPUT @Agte4991a;"DISP:TRAC3:Y:SPAC "&Fmt_c$
740   OUTPUT @Agte4991a;"DISP:FORM "&Display$
750   !
760
!#####################################################################
770   !  STEP3:  Calibration (FIXED)
780
!#####################################################################
790   !
800   OUTPUT @Agte4991a;"SENS:CORR1?"
810   ENTER @Agte4991a;Corr
820   IF Corr=1 THEN
830     Reply=FNMessage(@Agte4991a,"Do you perform a calibration
again?")
840     IF Reply<>0 THEN Cal_skip
850   END IF
860   !
870   !  -> Initial Settings
880   !
890   OUTPUT @Agte4991a;"SENS:CORR1:CKIT DEF"
900   OUTPUT @Agte4991a;"SENS:CORR1:COLL:FPO "&Cal_type$
910   !
920   !  -> Data Measurement
930   !
940   Result=FNCal(@Agte4991a,"OPEN")
950   IF Result<>0 THEN Prog_int
960   !
970   Result=FNCal(@Agte4991a,"SHORT")
980   IF Result<>0 THEN Prog_int
990   !
1000  Result=FNCal(@Agte4991a,"LOAD")
1010  IF Result<>0 THEN Prog_int
1020  !
```

```
1030  Reply=FNMessage(@Agte4991a,"Do you want to measure a LOW-LOSS
CAPACITOR?")
1040  IF Reply=0 THEN
1050    Result=FNCal(@Agte4991a,"LOW-LOSS C")
1060    IF Result<>0 THEN Prog_int
1070  END IF
1080  !
1090  OUTPUT @Agte4991a;"SENS:CORR1:COLL:SAVE"
1100  OUTPUT @Agte4991a;"*OPC?"
1110  ENTER @Agte4991a;Buff$
1120  PRINT "All cal-data measurement completion"
1130  PRINT
1140  !
1150 Cal_skip: !
1160  !
1170
!#####################################################################
1180  !  STEP4: Connect the Test Fixture
1190  !  STEP5: Setting the Electrical Length of the Test Fixture
1200
!#####################################################################
1210  !
1220  Reply=FNMessage(@Agte4991a,"Connect the "&Fixture$&" test
fixture to the E4991A.")
1230  IF Reply<>0 THEN Prog_int
1240  OUTPUT @Agte4991a;"SENS:CORR2:FIXT "&Fixture$
1250  OUTPUT @Agte4991a;"*OPC?"
1260  ENTER @Agte4991a;Buff$
1270  !
1280
!#####################################################################
1290  !  STEP6: Compensation (FIXED)
1300
!#####################################################################
1310  !
1320  !  -> Initial Settings
1330  !
1340  OUTPUT @Agte4991a;"SENS:CORR2:COLL:FPO "&Cal_type$
1350  !
1360  !  -> Data Measurement
1370  !
1380  Result=FNFixt_comp(@Agte4991a,"OPEN")
1390  IF Result<>0 THEN Prog_int
1400  !
1410  Result=FNFixt_comp(@Agte4991a,"SHORT")
1420  IF Result<>0 THEN Prog_int
1430  !
1440  OUTPUT @Agte4991a;"SENS:CORR2:COLL:SAVE"
1450  OUTPUT @Agte4991a;"*OPC?"
1460  ENTER @Agte4991a;Buff$
1470  PRINT "All compen-data measurement completion"
1480  PRINT
1490  !
1500
!#####################################################################
1510  !  STEP7: Connect the DUT (Chip Inductor)
1520
!#####################################################################
```

```
1530  !
1540 Meas_start: !
1550  Reply=FNMessage(@Agte4991a,"Connect the DUT to electrode plate
on the fixture.")
1560  IF Reply<>0 THEN Prog_int
1570  !
1580
!###################################################################
1590  !  STEP:8 Auto Scaling & Maximum Point Search
1600
!###################################################################
1610  !
1620  !  -> Performing a Single Sweep
1630  !
1640  OUTPUT @Agte4991a;"*CLS"
1650  OUTPUT @Agte4991a;"STAT:OPER:PTR 0"
1660  OUTPUT @Agte4991a;"STAT:OPER:NTR 16"
1670  OUTPUT @Agte4991a;"STAT:OPER:ENAB 16"
1680  OUTPUT @Agte4991a;"*SRE 128"
1690  ON INTR 7 GOTO Auto_scaling
1700  ENABLE INTR 7;2
1710  !
1720  OUTPUT @Agte4991a;"TRIG"
1730  DISP "Now sweeping....."
1740 Meas_wait:  GOTO Meas_wait
1750 Meas_end:  DISP
1760  OFF INTR 7
1770  !
1780  !  -> Performing an Auto-scale
1790  !
1800 Auto_scaling: !
1810  OUTPUT @Agte4991a;"DISP:TRAC1:Y:AUTO"
1820  OUTPUT @Agte4991a;"DISP:TRAC2:Y:AUTO"
1830  OUTPUT @Agte4991a;"DISP:TRAC3:Y:AUTO"
1840  !
1850  !  -> Searching the Maximum value
1860  !
1870  OUTPUT @Agte4991a;"CALC1:MARK1 ON"
1880  OUTPUT @Agte4991a;"CALC1:MARK1:ACT"
1890  OUTPUT @Agte4991a;"CALC1:MARK:FUNC "&Mkr_src$
1900  OUTPUT @Agte4991a;"CALC1:MARK:FUNC:EXEC"
1910  !
1920  !  -> Reading a marker's value
1930  !
1940  OUTPUT @Agte4991a;"CALC1:MARK1:X?"
1950  ENTER @Agte4991a;Freq_val
1960  OUTPUT @Agte4991a;"CALC1:MARK1:Y?"
1970  ENTER @Agte4991a;Imp_val
1980  !
1990  !  -> Displaying Measurement Result
2000  !
2010  PRINT " -------Measurement Result-------"
2020  PRINT USING "13A,6D.6D,6A";" Frequency: ",Freq_val/1.0E+6,"
[MHz]"
2030  PRINT USING "13A,6D.6D,6A";" Impedance: ",Imp_val," [ohm]"
2040  PRINT ""
2050  !
2060  Reply=FNMessage(@Agte4991a,"Performing a measurement again?")
```

```
2070  IF Reply=0 THEN Meas_start
2080  PRINT
2090  PRINT "Program ended!"
2100  GOTO Prog_end
2110  !
2120 Prog_int: !
2130  PRINT "Program interruption"
2140  !
2150 Prog_end: END
2160  !
2170  !
2180  DEF FNCal(@Agte4991a,Standard$)
2190    DIM Inp_char$[9],Err_mes$[50]
2200    INTEGER Err_no
2210    !
2220    Inp_char$="Y"
2230    !
2240    PRINT "Connect "&Standard$&" standard to the DUT port."
2250 Inp_start: !
2260    INPUT "OK? [Y/N]",Inp_char$
2270    IF UPC$(Inp_char$)="Y" THEN
2280      OUTPUT @Agte4991a;"*CLS"
2290      OUTPUT @Agte4991a;"STAT:OPER:PTR 0"
2300      OUTPUT @Agte4991a;"STAT:OPER:NTR 1"
2310      OUTPUT @Agte4991a;"STAT:OPER:ENAB 1"
2320      OUTPUT @Agte4991a;"*SRE 128"
2330      ON INTR 7 GOTO Meas_end
2340      ENABLE INTR 7;2
2350      SELECT Standard$
2360      CASE "OPEN"
2370        OUTPUT @Agte4991a;"SENS:CORR1:COLL STAN1"
2380      CASE "SHORT"
2390        OUTPUT @Agte4991a;"SENS:CORR1:COLL STAN2"
2400      CASE "LOAD"
2410        OUTPUT @Agte4991a;"SENS:CORR1:COLL STAN3"
2420      CASE "LOW-LOSS C"
2430        OUTPUT @Agte4991a;"SENS:CORR1:COLL STAN4"
2440      END SELECT
2450      DISP "Now measuring..."
2460 Meas_wait: GOTO Meas_wait
2470 Meas_end: DISP
2480      OFF INTR 7
2490      OUTPUT @Agte4991a;"SYST:ERR?"
2500      ENTER @Agte4991a;Err_no,Err_mes$
2510      IF Err_no=0 THEN
2520        PRINT Standard$&" data measurement completion"
2530        PRINT
2540        RETURN 0
2550      ELSE
2560        PRINT "Error: "&Err_mes$
2570        PRINT
2580        RETURN -1
2590      END IF
2600    ELSE
2610      PRINT
2620      RETURN -1
2630    END IF
2640  FNEND
```

```
2650  !
2660  !
2670  DEF FNFixt_comp(@Agte4991a,Standard$)
2680    DIM Inp_char$[9],Err_mes$[50]
2690    INTEGER Err_no
2700    !
2710    Inp_char$="Y"
2720    !
2730    PRINT "Connect "&Standard$&" standard to electrode plate on
the fixture."
2740    INPUT "OK? [Y/N]",Inp_char$
2750    IF UPC$(Inp_char$)="Y" THEN
2760      OUTPUT @Agte4991a;"*CLS"
2770      OUTPUT @Agte4991a;"STAT:OPER:PTR 0"
2780      OUTPUT @Agte4991a;"STAT:OPER:NTR 128"
2790      OUTPUT @Agte4991a;"STAT:OPER:ENAB 128"
2800      OUTPUT @Agte4991a;"*SRE 128"
2810      ON INTR 7 GOTO Meas_end
2820      ENABLE INTR 7;2
2830      SELECT Standard$
2840      CASE "OPEN"
2850        OUTPUT @Agte4991a;"SENS:CORR2:COLL STAN1"
2860      CASE "SHORT"
2870        OUTPUT @Agte4991a;"SENS:CORR2:COLL STAN2"
2880      END SELECT
2890      DISP "Now measuring..."
2900 Meas_wait: GOTO Meas_wait
2910 Meas_end: DISP
2920      OFF INTR 7
2930      OUTPUT @Agte4991a;"SYST:ERR?"
2940      ENTER @Agte4991a;Err_no,Err_mes$
2950      IF Err_no=0 THEN
2960        PRINT Standard$&" data measurement completion"
2970        PRINT
2980        RETURN 0
2990      ELSE
3000        PRINT "Error: "&Err_mes$
3010        PRINT
3020        RETURN -1
3030      END IF
3040    ELSE
3050      PRINT
3060      RETURN -1
3070    END IF
3080  FNEND
3090  !
3100  DEF FNMessage(@Agte4991a,Mes$)
3110    DIM Inp_char$[9]
3120    PRINT Mes$
3130    PRINT
3140 Inp_start: !
3150     INPUT "Ready? [Y/N]",Inp_char$
3160     SELECT UPC$(Inp_char$)
3170       CASE "Y"
3180         RETURN 0
3190       CASE "N"
3200         RETURN -1
3210       CASE ELSE
```

```
3220          GOTO Inp_start
3230      END SELECT
3240  FNEND
```

Macro (E4991A VBA) Example Program

Example 16-2 and Example 16-3 show how a basic measuring program (E4991A VBA) finds the self-resonance point of the inductor. The specifications for this application program are in accordance with the aforementioned “HTBasic example program” on page 254. This program is saved under the filenames bsc_meas.lcr (macro program). The structure and functions of the program are shown as follows.

NOTE For more on loading macros, see “Loading macros” on page 233.

Filename	Type of module	Object name	Function
bsc_meas.bas	module	bsc_meas	Procedure for basic measurement
bsc_meas.cls	class module	clsErr	Event to end the program when measurement failure occurs in the analyzer.

In the main procedure (bsc_meas.bas in this example), when an event created in another module (bsc_meas.cls in this example) is used, the event variable is defined as the Public type in the class module (line 20 in Example 16-3) and the object variable is stated and set as follows in the main module (lines 50 - 60 in Example 16-2). Then the object variable is disassociated from an actual object (line 1870 in Example 16-2).

Setting object variables

- Dim *variable* As New *Class name to be used*
- Set *object variable* As New *Library name to be used*

Disassociating object variables

- Set *object variable* = Nothing

NOTE End statement (lines 70, 140 and 210 in Example 16-3) is also used for disassociating object variables.

Variable.....	The user can specify any variable.
Class name to be used.....	Class name (clsErr in this example) specified in Name property in the class module. The user can specify any class name.
Object variable.....	Object variable property is defined by the user.
Library name to be used.....	E4991A library (E4991ALib.Application)

NOTE When using an application other than the E4991A VBA, it is necessary to execute the setting so that the E4991A library can be referred to and to activate the remote user interface function before creating/executing the program. See “E4991A Library” on page 244 and Chapter 10 “Using Remote User Interface” in the *E4991A Operation Manual* for details.

NOTE In order to execute a macro from the measurement screen of the E4991A without using the Visual Basic editor, it is necessary to define the procedure as a Public type (line 20 of

Example 16-2) in the module only. For more on the execution of macros, see “Executing macros” on page 230.

The details of the program (bsc_meas/bas) are explained below. The line numbers are added for the sake of explanation but are usually not displayed.

Lines 50 - 60	Defines the variable (Err) to use the event created in the class module (class name: clsErr). Next, sets the object variable (Err.Evnt) to the E4991A library.
Lines 200 - 240	Substitutes variables for the sweep condition. Sets the number of points (201), sweep parameter (frequency sweep type is logarithmic), sweep start value (1 MHz), sweep stop value (3 GHz) and electric current level of the source (1 mA).
Lines 250 - 320	Substitutes variables for the measurement parameter and display method. Sets the parameters for trace 1 (|Z|), trace 2 (Ls), and trace 3 (Q), the display formats for trace 1 (log), trace 2 (linear), and trace 3 (linear), the number of sweep-to-sweep averaging (three times), and the display method (displays all traces superimposed in one window).
Lines 330 - 350	Substitutes variables for the setting conditions for calibration, fixture compensation, and marker function. Sets calibration/fixture compensation data measurement point (fixed frequency point/fixed power point), test fixture used (16197A), and marker search function (to detect the maximum value).
Lines 370 - 380	Prompts preparation for measurement and waits for the **Yes** button to be clicked after the completion of preparation. Clicking the **No** button will abort the program. The subprogram Message is explained below.
Lines 440 - 450	Returns the E4991A to default status.
Lines 490 - 550	Sets the sweep conditions. In addition, sets the trigger source to the GPIB trigger.
Lines 590 - 670	Displays traces 1, 2, and 3 and sets the measurement parameter and display format for each trace.
Lines 680 - 700	Sets on the sweep-to-sweep averaging function (number of averaging: 3). In addition, superimposes and displays the three traces in one window.
Lines 740 - 790	Checks if the calibration function is on and, if it is on, prompts input on whether to execute calibration again. Click the **Yes** button to execute calibration again, or click the **No** button to skip calibration.
Lines 830 - 840	Sets the calibration kit to the attached 7-mm calibration kit and sets the calibration data measurement point to the fixed frequency point/fixed power point.
Lines 880 - 950	Measures open/short/load calibration data. Furthermore, the subprogram Cal will be explained later.
Lines 970 - 1010	Prompts input on whether to execute low-loss capacitor calibration. Click the **Yes** button to measure the low-loss capacitor calibration data, or click the **No** button to skip low-loss capacitor calibration.
Lines 1030 - 1050	Calculates the calibration coefficient based on the calibration data obtained and enables calibration.

Lines 1120 - 1150 Prompts the connection of the 1619A text fixture and waits for the **Yes** button to be clicked after the connection. Click the **No** Button to abort the program. Next, sets the test fixture to be used to the 16197A.

Line 1210 Sets the fixture compensation data to fixed frequency point/fixed power point.

Lines 1250 - 1290 Measures the open/short compensation data. The subprogram Fixt_comp is explained below.

Lines 1310 - 1330 Calculates the compensation coefficient based on the fixture compensation data obtained and enables fixture compensation.

Lines 1380 - 1390 Prompts connection of the sample to the electrode of the text fixture and waits for the **Yes** button to be clicked after the connection. Click the **No** button to abort the program.

Lines 1450 - 1500 Resets the sweep-to-sweep averaging, executes one sweep for the number of averaging, and then waits for completion of the sweep. If any error occurs during the sweep, the program is aborted.

Lines 1550 - 1570 Performs the auto-scale adjustment for traces 1, 2, and 3 and sets them to the optimum scale.

Lines 1610 - 1640 Sets on marker 1 for trace 1. After specifying marker 1 as the active marker, searches for the maximum value (self-resonance value) using the marker search feature.

Lines 1680 - 1710 Reads out the stimulus value (frequency) for marker 1 as well as the measured value (absolute value of the impedance) for trace 1.

Lines 1750 - 1800 Displays the read-out measurement results in the message box. Prompts input on whether to perform measurement again or whether to measure another sample of the same size. Click the **Yes** button to return to the connection part of the sample, or click the **No** button to end the program.

Line 1870 Disassociates the object variable used for the event function.

Below is an explanation of the function program Cal for measuring the calibration data.

Line 1960 Prompts the connection of the standard for the calibration specified by the variable Standard and waits for the **Yes** button to be clicked after the connection.

Lines 1990 - 2080 Measures the standard calibration data specified by the variable Standard and waits for the completion of measurement.

Lines 2090 - 2140 If measurement of the calibration data is not completed because of some kind of error, displays a message indicating interruption of measurement and returns the function program return value as -1. When measurement of the calibration data is completed, returns the function program return value as 0.

Below is an explanation of the function program Fixt_comp for measuring the fixture compensation data.

Line 2260 Prompts the connection of the standard for the fixture compensation specified by the variable Standard and waits for the **Yes** button to be clicked after the connection.

Lines 2290 - 2340 Measures the standard fixture compensation data specified by the

variable Standard and waits for the completion of measurement.

Lines 2350 - 2400 If measurement of the fixture compensation data is not completed because of some kind of error, displays a message indicating interruption of measurement and returns the function program return value as -1. When measurement of the fixture compensation data is completed, returns the function program return value as 0.

Below is an explanation of the function program Message for displaying messages.

Lines 2510 - 2570 Displays a message specified by the variable Mes and waits for either the **Yes** button or the **No** button to be clicked. When the **Yes** button is clicked, returns the function program return value as 0; when the **No** button is clicked, returns the function program return value as -1.

Example 16-2 Measuring the self-resonant point of an inductor (bsc_meas.bas)

```
 10|
  20|      Sub Main()
  30|        ' Preparation for Using Event Procedure
  40|
  50|        Dim Err As New clsErr
  60|        Set Err.Evnt = New E4991ALib.Application
  70|
  80|        ' STEP1: Preparation for a Measurement
  90|
 100|        Dim buff As String
 110|        Dim Swp_type As String
 120|       Dim Para_a As String, Para_b As String, Para_c As String
 130|        Dim Fmt_a As String, Fmt_b As String, Fmt_c As String,
Display As String
 140|        Dim Cal_type As String, Fixture As String, Mkr_src As
String
 150|        Dim Curr_lev As Double, Swp_start As Double, Swp_stop
As Double
 160|        Dim Freq_val As Double, Imp_val As Double
 170|       Dim swp_count As Integer, Corr As Integer, i As Integer,
nop As Integer, Reply As Integer, Result As Integer
 180|        Dim Answer As Long
 190|
 200|        nop = 201              '          Number of Points: 201
 210|        Swp_type = "LOG"       '        Sweep Type(X-axis):
LOGARITHMIC
 220|        Swp_start = 1000000#   '          Start Frequency: 1.0
MHz
 230|        Swp_stop = 3000000000# '           Stop Frequency: 3.0
GHz
 240|        Curr_lev = 0.001       '      Source Current Level: 1 mA
 250|        Para_a = "Z"           '   Measurement/     Trace1: |Z|
 260|        Para_b = "LS"          '     Parameters     Trace2: Ls
 270|        Para_c = "Q"           '                    Trace3: Q
 280|        Fmt_a = "LOG"          '   Display/         Trace1:
LOGARITHMIC
 290|        Fmt_b = "LIN"          '     Format(Y-axis) Trace2:
LINEAR
 300|       Fmt_c = "LIN"          '                    Trace3: LINEAR
 310|        swp_count = 3         '     Sweep Averaging Count: 3
 320|        Display = "OVER"       '     Display Split/Overlay:
OVERLAY
```

```
 330|        Cal_type = "FIX"       '         Calibration Type: FIXED
 340|         Fixture = "FXT16197A"  '               Test Fixture:
16197A
 350|         Mkr_src = "MAX"        ' Specified Search Function:
MAXIMUM
 360|
 370|        Reply = Message("All the preparations for a measurement
are complete?")
 380|         If Reply <> 0 Then GoTo Prog_int
 390|
 400|         ' STEP2: Specifying Measurement Conditions
 410|
 420|         '   Reset the E4991A to the Default State
 430|
 440|         SCPI.Output "SYST:PRES"
 450|         buff = SCPI.Query("*OPC?")
 460|
 470|         '   Specifying Sweep Conditions
 480|
 490|         SCPI.Output "SWE:POIN " & CStr(nop)
 500|         SCPI.Output "SWE:TYPE " & Swp_type
 510|         SCPI.Output "FREQ:STAR " & CStr(Swp_start)
 520|         SCPI.Output "FREQ:STOP " & CStr(Swp_stop)
 530|         SCPI.Output "SOUR:CURR:MODE FIX"
 540|         SCPI.Output "SOUR:CURR " & CStr(Curr_lev)
 550|         SCPI.Output "TRIG:SOUR BUS"
 560|
 570|         '   Specifying Measurement Parameters
 580|
 590|         SCPI.Output "DISP:TRAC1 ON"
 600|         SCPI.Output "DISP:TRAC2 ON"
 610|         SCPI.Output "DISP:TRAC3 ON"
 620|         SCPI.Output "CALC1:FORM " & Para_a
 630|         SCPI.Output "CALC2:FORM " & Para_b
 640|         SCPI.Output "CALC3:FORM " & Para_c
 650|         SCPI.Output "DISP:TRAC1:Y:SPAC " & Fmt_a
 660|         SCPI.Output "DISP:TRAC2:Y:SPAC " & Fmt_b
 670|         SCPI.Output "DISP:TRAC3:Y:SPAC " & Fmt_c
 680|         SCPI.Output "CALC:AVER:COUN " & CStr(swp_count)
 690|         SCPI.Output "CALC:AVER ON"
 700|         SCPI.Output "DISP:FORM " & Display
 710|
 720|         ' STEP3: Calibration
 730|
 740|         SCPI.Output "SENS:CORR1?"
 750|         SCPI.Enter Corr
 760|         If Corr = 1 Then
 770|           Reply = Message("Do you perform a calibration?")
 780|           If Reply <> 0 Then GoTo Cal_skip
 790|         End If
 800|
 810|         '   Initial Settings
 820|
 830|         SCPI.Output "SENS:CORR1:CKIT DEF"
 840|         SCPI.Output "SENS:CORR1:COLL:FPO " & Cal_type
 850|
 860|         '   Data Measurement
 870|
```

```
 880|        Result = Cal("OPEN")
 890|        If Result <> 0 Then GoTo Prog_int
 900|
 910|        Result = Cal("SHORT")
 920|        If Result <> 0 Then GoTo Prog_int
 930|
 940|        Result = Cal("LOAD")
 950|        If Result <> 0 Then GoTo Prog_int
 960|
 970|        Reply = Message("Do you want to measure a LOW-LOSS
CAPACITOR?")
 980|        If Reply = 0 Then
 990|          Result = Cal("LOW-LOSS C")
1000|          If Result <> 0 Then GoTo Prog_int
1010|        End If
1020|
1030|        SCPI.Output "SENS:CORR1:COLL:SAVE"
1040|        buff = SCPI.Query("*OPC?")
1050|       MsgBox "All cal-data measurement completion", vbOKOnly,
"Calibration"
1060|
1070|  Cal_skip:
1080|
1090|        ' STEP4: Connect the Test Fixture
1100|        ' STEP5: Setting the Electrical Length of the Test
Fixture
1110|
1120|        Reply = Message("Connect the " & Fixture & " test
fixture to the E4991A.")
1130|        If Reply <> 0 Then GoTo Prog_int
1140|        SCPI.Output "SENS:CORR2:FIXT " & Fixture
1150|        buff = SCPI.Query("*OPC?")
1160|
1170|        ' STEP6: Compensation (FIXED)
1180|
1190|        ' Initial Settings
1200|
1210|        SCPI.Output "SENS:CORR2:COLL:FPO " & Cal_type
1220|
1230|        ' Data Measurement
1240|
1250|        Result = Fixt_comp("OPEN")
1260|        If Result <> 0 Then GoTo Prog_int
1270|
1280|        Result = Fixt_comp("SHORT")
1290|        If Result <> 0 Then GoTo Prog_int
1300|
1310|        SCPI.Output "SENS:CORR2:COLL:SAVE"
1320|        buff = SCPI.Query("*OPC?")
1330|        MsgBox "All compen-data measurement completion",
vbOKOnly, "Compensation"
1340|
1350|        ' STEP7: Connect the DUT (Chip Inductor)
1360|
1370|  Meas_start:
1380|       Reply = Message("Connect the DUT to electrode plate on
the fixture.")
1390|        If Reply <> 0 Then GoTo Prog_int
```

```
1400|
1410|        ' STEP8: Auto Scaling & Maximum Point Search
1420|
1430|        ' Performing a Single Sweep
1440|
1450|        SCPI.Output "CALC:AVER:CLE"
1460|        Answer = SingleMeasure
1470|        If Answer = 0 Then
1480|        MsgBox "A single sweep aborted", vbOKOnly, "Impedance
measurement"
1490|        GoTo Prog_int
1500|        End If
1510|
1520|        ' Performing an Auto-scale
1530|
1540|  Auto_scaling:
1550|        SCPI.Output "DISP:TRAC1:Y:AUTO"
1560|        SCPI.Output "DISP:TRAC2:Y:AUTO"
1570|        SCPI.Output "DISP:TRAC3:Y:AUTO"
1580|
1590|        ' Searching the Maximum Value
1600|
1610|        SCPI.Output "CALC1:MARK1 ON"
1620|        SCPI.Output "CALC1:MARK1:ACT"
1630|        SCPI.Output "CALC1:MARK:FUNC " & Mkr_src
1640|        SCPI.Output "CALC1:MARK:FUNC:EXEC"
1650|
1660|        ' Reading a marker's value
1670|
1680|        SCPI.Output "CALC1:MARK1:X?"
1690|        SCPI.Enter Freq_val
1700|        SCPI.Output "CALC1:MARK1:Y?"
1710|        SCPI.Enter Imp_val
1720|
1730|        ' Displaying Measurement Result
1740|
1750|        Reply = Message("Frequency: " & CStr(Freq_val /
1000000#) & "[MHz]" & _
1760|                        vbCrLf & "Impedance: " & CStr(Imp_val)
& "[ohm]" & _
1770|                          vbCrLf & vbCrLf & "Performing a
measurement again?")
1780|        If Reply = 0 Then GoTo Meas_start
1790|        MsgBox "Program ended!", vbOKOnly, "Impedance
measurement"
1800|        GoTo Prog_end
1810|
1820|  Prog_int:
1830|        MsgBox "Program interruption", vbOKOnly, "Impedance
measurement"
1840|
1850|  Prog_end:
1860|
1870|        Set Err.Evnt = Nothing
1880|
1890|      End Sub
1900|
1910|      Function Cal(Standard As String) As Integer
```

```
1920|
1930|        Dim Reply As Integer
1940|        Dim Answer As Long
1950|
1960|        Reply = Message("Connect " & Standard & " standard to
DUT port.")
1970|
1980|        If Reply = 0 Then
1990|          Select Case Standard
2000|          Case "OPEN"
2010|            Answer = CalMeasure(CalOpen)
2020|          Case "SHORT"
2030|            Answer = CalMeasure(CalShort)
2040|          Case "LOAD"
2050|            Answer = CalMeasure(CalLoad)
2060|          Case "LOW-LOSS C"
2070|            Answer = CalMeasure(CalLowLossC)
2080|          End Select
2090|          If Answer = 0 Then
2100|           MsgBox Standard & " Calibration aborted!", vbOKOnly,
"Calibration"
2110|            Cal = -1
2120|          Else
2130|            Cal = 0
2140|          End If
2150|        Else
2160|          Cal = -1
2170|        End If
2180|
2190|      End Function
2200|
2210|      Function Fixt_comp(Standard As String) As Integer
2220|
2230|        Dim Reply As Integer
2240|        Dim Answer As Long
2250|
2260|        Reply = Message("Connect " & Standard & " standard to
electrode plate on the test fixture.")
2270|
2280|        If Reply = 0 Then
2290|          Select Case Standard
2300|          Case "OPEN"
2310|            Answer = CompenMeasure(CompenOpen)
2320|          Case "SHORT"
2330|            Answer = CompenMeasure(CompenShort)
2340|          End Select
2350|          If Answer = 0 Then
2360|            MsgBox Standard & " Compensation aborted!",
vbOKOnly, "Compensation"
2370|            Fixt_comp = -1
2380|          Else
2390|            Fixt_comp = 0
2400|          End If
2410|        Else
2420|          Fixt_comp = -1
2430|        End If
2440|
2450|      End Function
```

```
2460|
2470|      Function Message(Mes As String) As Integer
2480|
2490|        Dim Inp_char As Integer
2500|
2510|       Inp_char = MsgBox(Mes, vbYesNo + vbQuestion, "Impedance
measurement")
2520|
2530|        If Inp_char = vbYes Then
2540|          Message = 0
2550|        Else
2560|          Message = -1
2570|        End If
2580|
2590|      End Function
```

Example 16-3 **Measuring the self-resonant point of an inductor (bsc_meas.cls)**

When using the event provided in the E4991A, the following programing steps are created.

- Public WithEvents *event variable* As E4991ALib.Application
- Private Sub *event variable_Event* ( )
  ~
- End Sub

The details of the program (bsc_meas.cls) are explained below. The line numbers are added for explanatory purposes but are not usually displayed.

Line 20	Defines the variable (Evnt) as the Public type so that the event procedure can be used in different procedures.
Lines 40 - 90	Terminates the program when a “PLL unlock” error occurs inside the E4991A.
Lines 110 - 160	Terminates the program when a “DC bias overload” error occurs inside the E4991A.
Lines 180 - 230	Forces the program to end when an “RF overload” error occurs inside the E4991A.

```
 10|
 20|  Public WithEvents Evnt As E4991ALib.Application
 30|
 40|  Private Sub Evnt_Unlocked()
 50|
 60|  MsgBox "Error: PLL Unlock" & vbCrLf & vbCrLf & "Program interruption", vbExclamation,
"E4991A Internal Error"
 70|  End
 80|
 90|  End Sub
100|
110|  Private Sub Evnt_DcBiasOverload()
120|
130|  MsgBox "Error: Dc bias overload" & vbCrLf & vbCrLf & "Program interruption",
vbExclamation, "E4991A Internal Error"
140|  End
```

```
150|
160|  End Sub
170|
180|  Private Sub Evnt_RfOverload()
190|
200|  MsgBox "Error: RF overload" & vbCrLf & vbCrLf & "Program interruption", vbExclamation,
"E4991A Internal Error"
210|  End
220|
230|  End Sub
240|
```

17 GPIB Command Reference

This chapter provides the GPIB command reference of the Agilent E4991A. The command references are written in abbreviated form and listed in alphabetic order.

Conventions

This section defines the terms and symbols used as conventions in the command references.

Format

The section titled “Format” shows the format(s) that is (are) used to transmit the command to the E4991A. Each format consists of the command label and parameter fields, which are separated by spaces.

If two or more parameters appear in a format, they are separated by commas (,). Two periods (..) inserted between commas indicate that at least one parameter has been omitted. If there are character string parameters (e.g., <character-string>, <character-string-1>), each parameter must be enclosed within double quotation marks (").

Any lowercase alphabetic characters in a command may be omitted. For example, the command label **:SYSTem:PRESet** may be abbreviated to the **SYST:PRES** command on page 523.

The following symbols are used in the format section:

<>	A character string enclosed within angle brackets represents a parameter that is required to transmit the command.
[]	Anything enclosed within brackets may be omitted.
{}	Only one of the items enclosed within braces can be selected. These items are separated by vertical strokes (|).

Description

The section titled “Description” describes how to use the command and what is does when executed.

Parameters

The section titled “Parameters” describes the parameters required to transmit the command. If a parameter is of a numeric (integer or floating-point) or a character string type and enclosed within angle brackets (< >), the “Parameters” section contains the parameter’s description, range, initial setting, etc. If a parameter is enclosed within braces ({ }), i.e., selectable, the section contains a description of the options.

Data format

The E4991A uses the following data types for parameter input. These also apply to Query responses.

1. Numeric data (ASCII data)

   Numeric values are transmitted in one of the following formats:

   - Integer type

     A numeric value is represented as an integer. For example, numeric value 201 is represented as **"+201"**. The sign at the head is omitted in some cases.

   - Floating-point type

     Floating-point data are represented as a numeric value including the decimal point. For example, numeric value 1000 is represented as **"+1.0E+3"**. The sign at the head is omitted in some cases.

     The real and imaginary parts of complex data are represented in floating-point format.

2. Character data

   ASCII character data are used for character data. For example, **POL** represents the polar coordinate format used when the E4991A setting is verified by Query. Character data are similar to character string data; however, character string data are enclosed within double quotation marks (" "), whereas character data are not.

3. Character string data

   ASCII character data enclosed within double quotation marks are used for character string data. For example, when setting the trace title, type a character string enclosed within double quotations to represents the title (e.g., **"Measurement Data"**).

4. Block data (binary data)

   The first digit following the pound symbol (#) represents the number of digits in the number of bytes of the subsequent data. The next digit actually represents the number of bytes of the data transferred. For example, the seven-byte data ABC+XYZ is represented as **"#17ABC+XYZ<newline><^END>"**.

Query response

The section titled “Query response” shows the format of the data that are read out when the command can enable Query (i.e., data readout).

The parameters read out are enclosed within braces ({ }). If the pair of braces contains items separated by vertical strokes (|), this indicates that only one of them will be read out.

If two or more parameters are to be read out, they are separated by commas (,). Two periods (..) inserted between commas indicate that the data are omitted. For example, "{numeric 1},..,{numeric 4}" indicates that the four items {numeric 1},{numeric 2},{numeric 3},{numeric 4} will be read out.

<newline><^END> appended to the parameter field is the program message terminator.

Related command(s)

The section titled “Related command(s)” lists one or more commands related to the currently described one.

Front Panel Equivalents

The section titled “Front Panel Equivalents” shows the operation of the front panel keys that has the same effect as executing the currently described command.

IEEE subsystem

This section describes the GPIB commands of the IEEE subsystem.

*CLS

Format

*CLS

Description

Initializes the following. (No query)

- Error Queue
- Status Byte Register
- Operation Status Register
- Questionable Status Register
- Questionable Status Hardware Register
- Questionable Status Limit Register
- Questionable Status Search Register
- Standard Event Status Register

Front Panel Equivalents

Unavailable.

*ESE

Format

*ESE <numeric>

*ESE?

Description

Sets the value of the Standard Event Status Enable register.

See Figure B-3, “Status Register Structure (1/2),” on page 561, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the Enable register
Data type	Integer
Range	0 to 255
Default	0

If the specified parameter is outside the range, the bit-by-bit logical sum resulting from an AND operation with 255 (0xff) will be assumed.

Query response

{numeric}<newline><^END>

Related command

***ESR?** command on page 280

Front Panel Equivalents

Unavailable.

*ESR?

Format

*ESR?

Description

Returns the value of the Standard Event Status register. Execution of the command clears the register value. (Query only)

See Figure B-3, “Status Register Structure (1/2),” on page 561, for details of the status register structure.

See Table B-2, “Status Bit Definition of Standard Event Status Register,” on page 564 for the bit definition of the Standard Event Status register.

Query response

{numeric}<newline><^END>

Returns the integer value.

Front Panel Equivalents

Unavailable.

*IDN?

Format: *IDN?

Description: Returns the E4991A product information. (Query only)

Query response: {string 1},{string 2},{string 3},{string 4}<newline><^END>

The following product information is read out:

{string 1}	Manufacturer. Always "Agilent Technologies".
{string 2}	Model number. Always "E4991A".
{string 3}	Serial number
{string 4}	Firmware version number (e.g., "01.00")

Front Panel Equivalents: Unavailable.

*OPC

Format: *OPC

Description: When all the pending operations have ended, sets OPC bit (Bit 0) of the Standard Event Status Register. (No query)

Front Panel Equivalents: Unavailable.

*OPC?

Format: *OPC?

Description: Returns 1 when all the pending operations end. (Query only)

Query response: {1}<newline><^END>

Front Panel Equivalents: Unavailable.

*OPT?

Format

*OPT?

Description

Returns the identification code(s) of the option(s) installed on the E4991A. If no option is installed, this command returns 0. If two or more options are installed, it returns a string of the option identification codes separated by commas (,). (Query only)

The E4991A offers the following option identification codes:

0	No Option
001	dc bias function
1D5	High Stability Frequency Reference
002	Material Measurement Software

Query response

{string}<newline><^END>

Front Panel Equivalents

Unavailable.

*RST

Format

*RST

Description

Resets the E4991A to its initial settings. Initialization by the **SYST:PRES** command and trigger setting by the **INIT:CONT OFF** command take place. (No query)

Related commands

INIT:CONT command on page 382

SYST:PRES command on page 523

Front Panel Equivalents

Unavailable.

*SRE

Format

*SRE <numeric>

*SRE?

Description

Sets the value of the Service Request Enable register.

See Figure B-3, “Status Register Structure (1/2),” on page 561, for details of the status register structure.

Parameters

	<numeric>
Description	Setting of the Register
Data type	Integer
Range	0 to 255
Default	0

If the specified parameter is outside the range, the bit-by-bit logical sum resulting from an AND operation with 255 (0xff) will be assumed. Bit 6 cannot be set to 1.

Query response

{numeric}<newline><^END>

Related commands

***STB?** command on page 283

Front Panel Equivalents

Unavailable.

*STB?

Format

*STB?

Description

Returns the value of the Status Byte register. (Query only)

See Figure B-3, “Status Register Structure (1/2),” on page 561, for details of the status register structure.

See Table B-1, “Status Bit Definition of Status Byte Register,” on page 563 for the bit definition of the Status Byte register.

Query response

{numeric}<newline><^END>

Returns the integer value.

Front Panel Equivalents

Unavailable.

*TRG

Format *TRG

Description Triggers the E4991A when the trigger source has been set for the GPIB (specified as "BUS" in the **TRIG:SOUR**).

Related commands **TRIG:SOUR** command on page 526

Front Panel Equivalents Unavailable.

*TST?

Format *TST?

Description Executes a self-test and returns the test results. (Query only)

Query response {numeric}<newline><^END>

	Description
0	Result of the self-test is PASS.
except 0	Result of the self-test is FAIL.

Front Panel Equivalents **System** - **Diagnostic** - **Internal Test** - Test Start

*WAI

Format *WAI

Description Prohibits the instrument from executing any new commands until all pending overlapped commands have been completed. (No query)

Front Panel Equivalents Unavailable.

Table 17-1 Overlapped Commands

DISPlay Subsystem:

DISP:TEXT on page 355

CALCulate:MARKer Subsystem:

CALC{1-5}:MARK:SET on page 336

SENSe:CORRection Subsystem:

SENS:CORR1:COLL on page 437
SENS:CORR1:COLL:FPO on page 438
SENS:CORR1:COLL:SAVE on page 439
SENS:CORR2:COLL on page 449
SENS:CORR2:COLL:FPO on page 450
SENS:CORR2:COLL:SAVE on page 451
SENS:CORR2:FIXT on page 454
SENS:CORR2:FIXT:EDEL:USER:DIST on page 456

SENSe:AVERage Subsystem:

AVER on page 287
AVER:COUN on page 288

SENSe:FREQuency Subsystem:

FREQ on page 375
FREQ:CENT on page 376
FREQ:SPAN on page 377
FREQ:SPAN:FULL on page 377
FREQ:STAR on page 378
FREQ:STOP on page 379

SENSe:MODE Subsystem:

MODE on page 393

SENSe:SEGMent Subsystem:

SEGM{1-16}:CURR on page 398
SEGM{1-16}:CURR:LIM on page 400
SEGM{1-16}:CURR:OFFS on page 401
SEGM{1-16}:DATA on page 403
SEGM:DATA:ALL on page 405
SEGM:DEL:ALL on page 406
SEGM{1-16}:FREQ:CENT on page 407
SEGM{1-16}:FREQ:SPAN on page 408
SEGM{1-16}:FREQ:STAR on page 409
SEGM{1-16}:FREQ:STOP on page 410
SEGM{1-16}:POW on page 411
SEGM{1-16}:SWE:POIN on page 413
SEGM{1-16}:VOLT on page 414
SEGM{1-16}:VOLT:LIM on page 415
SEGM{1-16}:VOLT:OFFS on page 416

SENSe:SWEep Subsystem:

SWE:DIR on page 508
SWE:DWEL1 on page 508
SWE:DWEL2 on page 509
SWE:DWEL3 on page 510
SWE:POIN on page 511
SWE:TIME on page 513
SWE:TIME:AUTO on page 514
SWE:TYPE on page 515

SOURce Subsystem:

All of the commands

E4991A GPIB command

This section describes the GPIB commands specific to E4991A.

ABOR

Format

ABORt

Description

Resets the trigger system to put the trigger sequence in the idle state. Also sets the continuous activation of trigger system to off. (No query)

Related commands

INIT:CONT command on page 382

INIT command on page 382

Front Panel Equivalents

Unavailable.

AVER

Format

[SENSe:]AVERage[:STATe] {ON|OFF|1|0}

[SENSe:]AVERage[:STATe]?

Description

Turns on/off the point averaging function.

In addition, use the **AVER:COUN** command to set the averaging factor.

Parameters

	Description
ON or 1 (Default)	Turns on the point averaging function.
OFF or 0	Turns off the point averaging function.

Query response

{1|0}<newline><^END>

Related commands

AVER:COUN command on page 288

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Point Average

AVER:COUN

Format

[SENSe:]AVERage:COUNt <numeric>

[SENSe:]AVERage:COUNt?

Description

Sets the averaging factor when using the point averaging function. Only setting the averaging factor does not set the point averaging function to on. Use the **AVER** command to set the point averaging function to on.

In addition, use the **SEGM{1-16}:AVER:COUN** command to set the point averaging factor for the segment sweep.

Parameters

	<numeric>
Description	Point averaging factor
Data type	Integer
Range	1 to 100
Default	1

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

AVER command on page 287

SEGM{1-16}:AVER:COUN command on page 396

Front Panel Equivalents

Stimulus - **Sweep Setup**... - Point Average

CALC:AVER

Format

CALCulate:AVERage[:STATe] {ON|OFF|1|0}

CALCulate:AVERage[:STATe]?

Description

Turns on/off the sweep averaging function.

In addition, use the **CALC:AVER:COUN** command to set the averaging factor.

Parameters

	Description
ON or 1	Turns on the sweep averaging function.
OFF or 0 (Default)	Turns off the sweep averaging function.

Query response

{1|0}<newline><^END>

Related commands

CALC:AVER:COUN command on page 290

Front Panel Equivalents

Meas/Format - **Meas/Format...** - Sweep Average[On/Off]

CALC:AVER:CLE

Format

CALCulate:AVERage:CLEar

Description

Resets the sweep averaging. Also restarts the sweep from the sweep count 1 when the E4991A is performing sweep. (No query)

Front Panel Equivalents

Meas/Format - **Meas/Format...** - Sweep Average Restart

CALC:AVER:COUN

Format

CALCulate:AVERage:COUNt <numeric>

CALCulate:AVERage:COUNt?

Description

Sets the averaging factor when using the sweep averaging function. Only setting the averaging factor does not set the sweep averaging function to on.

In addition, use the **CALC:AVER** command to set the sweep averaging function to on.

Parameters

	<numeric>
Description	Sweep averaging factor
Data type	Integer
Range	1 to 999
Default	16

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

CALC:AVER command on page 289

Front Panel Equivalents

Meas/Format - **Meas/Format...** - Swp Avg Count

CALC:BMON

Format

CALCulate[:EVALuate]:BMONitor[:STATe] {ON|OFF|1|0}

CALCulate[:EVALuate]:BMONitor[:STATe]?

Description

Turns on/off the dc bias monitor function. This command is available when Option 001 (dc bias function) is installed.

It is necessary to set markers with the **CALC{1-5}:MARK{1-8}** command or the **CALC{1-5}:MARK:REF** command before sending this command.

In addition, use the **CALC:DATA:MON?** command to read the dc bias level monitor array.

Parameters

	Description
ON or 1	Turns on the dc bias monitor function.
OFF or 0 (Default)	Turns off the dc bias monitor function.

Query response

{1|0}<newline><^END>

Related commands

CALC:DATA:MON? command on page 292

CALC{1-5}:MARK{1-8} command on page 304

CALC{1-5}:MARK:REF command on page 328

Front Panel Equivalents

Stimulus - **Source...** - Bias Monitor: [On/Off]

CALC:DATA:MON?

Format

CALCulate:DATA:MONitor? {V|I}

Description

Reads the dc bias level monitor array of all measurement points. This command is available when Option 001 (dc bias function) is installed. The dc bias monitor function has to be set to on by using the **CALC:BMON** command before sending this command. (Query only)

Parameters

	Description
V	Specifies the voltage value.
I	Specifies the current value.

Query response

{numeric 1}, {numeric 2},.., {numeric N-1}, {numeric N}<newline><^END>

Where N is the number of measurement points.

It is read in the floating-point value.

Related commands

CALC:BMON command on page 291

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

CALC{1-5}:DATA?

Format

CALCulate{1-5}:DATA? {FDATA|FMEM}

Description

Reads the data trace array or the memory trace array. (Query only)

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5)

	Description
FDATA	Specifies the data trace array
FMEM	Specifies the memory trace array

The memory trace array stores the data trace array's content copied with the **CALC{1-5}:MATH:MEM** command or the frequency characteristic simulation results by executing the **CALC{1-5}:EPAR:SIM** command in the equivalent circuit analysis.

Query response

- With scalar trace

  {numeric 1}, {numeric 2},.., {numeric N-1}, {numeric N}<newline><^END>

	Description
{numeric n}	Data at the n-th measurement point

- With complex trace

  {numeric 1}, {numeric 2},.., {numeric N×2-1}, {numeric N×2}<newline><^END>

	Description
{numeric n × 2 - 1}	Real part of data (complex type) at the n-th measurement point
{numeric n × 2}	Imaginary part of data (complex type) at the n-th measurement point

Where N is the number of measurement points.

It is read in the floating-point value.

Related commands

CALC{1-5}:MATH:MEM command on page 341

Front Panel Equivalents

Unavailable.

CALC{1-5}:DATA:EPAR

Format

CALCulate{1-5}:DATA:EPARameter {EQC0|EQC1|EQL1|EQR1},<numeric>

CALCulate{1-5}:DATA:EPARameter? {EQC0|EQC1|EQL1|EQR1}

Description

Sets each value of equivalent circuit parameters.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
EQC0	Equivalent circuit parameter C0
EQC1	Equivalent circuit parameter C1
EQL1	Equivalent circuit parameter L1
EQR1	Equivalent circuit parameter R1

	<numeric>
Description	Equivalent circuit parameter value
Data type	Floating point
Default	0
Unit	F (for C0 and C1), H (for L1), and Ω (for R1)

Query response

{numeric}<newline><^END>

Front Panel Equivalents

Utility - **Equivalent Circuit...** - R1|C1|L1|C0

CALC{1-5}:EPAR

Format

CALCulate{1-5}:EPARameters

Description

Executes the equivalent circuit analysis in the selected equivalent circuit model. In addition, executes the equivalent circuit analysis in the marker partial search range. When the marker partial search range is not set to on with the **CALC{1-5}:MARK:FUNC:DOM** command, executes the equivalent circuit analysis in the entire sweep range. (No query)

In addition, use the **CALC{1-5}:EPAR:CIRC** command to select the equivalent circuit mode.

Also, the equivalent circuit parameters C0, C1, L1, and R1 that were acquired in the equivalent circuit analysis can be read when executing the **CALC{1-5}:DATA:EPAR** command in the query.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

Related commands

CALC{1-5}:EPAR:CIRC command on page 296

CALC{1-5}:DATA:EPAR command on page 294

Front Panel Equivalents

Utility - **Equivalent Circuit...** - Calculate Parameters

CALC{1-5}:EPAR:CIRC

Format

CALCulate{1-5}:EPARameters:CIRCuit[:TYPE] {A|B|C|D|E}

CALCulate{1-5}:EPARameters:CIRCuit[:TYPE]?

Description

Specifies the equivalent circuit model in the equivalent circuit analysis.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
A (Default)	Specifies the equivalent circuit model A
B	Specifies the equivalent circuit model B
C	Specifies the equivalent circuit model C
D	Specifies the equivalent circuit model D
E	Specifies the equivalent circuit model E

Query response

{A|B|C|D|E}<newline><^END>

Front Panel Equivalents

Utility - **Equivalent Circuit...** - Select Circuit - A|B|C|D|E

CALC{1-5}:EPAR:SIM

Format

CALCulate{1-5}:EPARameters:SIMulation

Description

Simulates and displays the frequency characteristic of the equivalent circuit. (No query)

In addition, the simulation result is stored in the memory trace so that it can be read with the **CALC{1-5}:DATA?** command.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

Related commands

CALC{1-5}:DATA? command on page 293

Front Panel Equivalents

Utility - **Equivalent Circuit...** - Simulate Freq-Char

CALC{1-5}:FORM

Format

- With scalar trace

  CALCulate{1-3}:FORMat {Z|Y|LS|LP|CS|CP|RS|RP|D|Q|R|X|G|B|ZPH|YPH|RC|RCPH|RCX|RCY|P|PRE|PLF|PLT|DC|DCR|DCLF|DCLT}

  CALCulate{1-3}:FORMat?

- With complex trace

  CALCulate{4-5}:FORMat {Z|Y|RC|P|DC}

  CALCulate{4-5}:FORMat?

Description

Sets the measurement parameters. A maximum of five measurement parameters can be arbitrarily selected.

Parameters

The following measurement parameters can be selected:

- With scalar trace:

Sub-block	Description
CALCulate{1-3}	Specifies the trace number (1 to 3).

	Description
Z	Absolute value of impedance (|Z|)
Y	Absolute value of admittance (|Y|)
LS	Equivalent series inductance (Ls)
LP	Equivalent parallel inductance (Lp)
CS	Equivalent series capacitance (Cs)
CP	Equivalent parallel capacitance (Cp)
RS	Equivalent series resistance (Rs)
RP	Equivalent parallel resistance (Rp)
D	Dissipation factor (D)
Q	Quality factor (Q)
R	Series resistance (R)
X	Reactance (X)
G	Conductance (G)
B	Susceptance (B)
ZPH	Phase of impedance (θ_z)
YPH	Phase of admittance (θ_y)

	Description
RC	Absolute value of reflection coefficient (|Γ|)
RCPH	Phase of reflection coefficient (θγ)
RCX	Real part of reflection coefficient (Γx)
RCY	Imaginary part of reflection coefficient (Γy)
P*1	Absolute value of complex permeability (|μr|)
PRE*1	Real part of complex permeability (μr')
PLF*1	Imaginary part of complex permeability (μr")
PLT*1	Magnetic loss tangent (tanδ (μ))
DC*2	Absolute value of complex permittivity (|εr|)
DCR*2	Real part of complex permittivity (εr')
DCLF*2	Imaginary part of complex permittivity (εr")
DCLT*2	Dielectric loss tangent (tanδ (ε))

*1. Can be selected when magnetic measurement mode is selected with the **MODE** command.
*2. Can be selected when electric measurement mode is selected with the **MODE** command.

- With complex trace:

Sub-block	Description
CALCulate{4-5}	Specifies the trace number (4 to 5)

	Description
Z	Impedance (Z)
Y	Admittance (Y)
RC	Reflection coefficient (Γ)
P*1	Complex permeability (μr)
DC*2	Complex permittivity (εr)

*1. Can be selected when magnetic measurement mode is selected with the **MODE** command.
*2. Can be selected when electric measurement mode is selected with the **MODE** command.

Query response

- With scalar trace:

  {Z|Y|LS|LP|CS|CP|RS|RP|D|Q|R|X|G|B|ZPH|YPH|RC|RCPH|RCX|RCY|P|PRE|PLF|PLT|DC|DCR|DCLF|DCLT}<newline><^END>

- With complex trace

  {Z|Y|RC|P|DC}<newline><^END>

Related commands **MODE** command on page 393

Front Panel Equivalents **Meas/Format** - **Meas/Format...** - Meas Parameter

CALC:FORM:PAR:DIE

Format

CALCulate:FORMat:PARameter:DIElectric <numeric>

CALCulate:FORMat:PARameter:DIElectric?

Description

Sets the thickness of dielectric material in the dielectric measurement. This command is available when Option 002 (material measurement software) is installed.

Parameters

	<numeric>
Description	Thickness of dielectric material
Data type	Floating point
Range	1E-6 to 4.8E-3
Default	1E-6
Resolution	1E-10
Unit	m (meter)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Front Panel Equivalents **Utility** - **Material Option...** - Thickness

CALC{1-3}:FORM:PAR:EPH

Format

CALCulate{1-3}:FORMat:PARameter:EPHase {ON|OFF|1|0}

CALCulate{1-3}:FORMat:PARameter:EPHase?

Description

Turns on/off the expanded phase display function, which allows phases to be below -180 or above 180 degrees, when the measurement parameter is the phase. This command is ignored for measurement parameters other than phase.

Parameters

Sub-block	Description
CALCulate{1-3}	Specifies the trace number (1 to 3).

	Description
ON or 1 (Default)	Set the expanded phase display to on.
OFF or 0	Set the expanded phase display to off.

Query response

{1|0}<newline><^END>

Front Panel Equivalents

Meas Format - **Meas/Format...** - Expand Phase [On/Off]

CALC:FORM:PAR:MAG

Format

CALCulate:FORMat:PARameter:MAGnetic <numeric 1>,<numeric 2>,<numeric 3>

CALCulate:FORMat:PARameter:MAGnetic?

Description

Sets the inner diameter, outer diameter, and height of the toroidal core in the magnetic measurement. This command is available when Option 002 (material measurement software) is installed.

Parameters

	<numeric 1>	**<numeric 2>**	**<numeric 3>**
Description	Inner diameter of core	Outer diameter of core	Height of core
Data type	Floating point	Floating point	Floating point
Range (16454S)	3.04E-3 to 9E-3	3.04E-3 to 9E-3	1E-5 to 3.65E-3
Range (16454L)	3E-3 to 21E-3	3E-3 to 21E-3	1E-5 to 11.6E-3
Default (16454S)	3.04E-3	9E-3	3.65E-3
Default (16454L)	3E-3	21E-3	11.6E-3
Resolution	1E-7	1E-7	1E-9
Unit	m (meter)	m (meter)	m (meter)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric 1}, {numeric 2}, {numeric 3}<newline><^END>

Front Panel Equivalents

Utility - **Material Option...** - Height|Inner Diameter|Outer Diameter

CALC{1-5}:FORM:UNIT:ANGL

Format

CALCulate{1-5}:FORMat:UNIT:ANGLe {DEG|RAD}

CALCulate{1-5}:FORMat:UNIT:ANGLe?

Description

Sets the display unit for the phase display format.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
DEG (Default)	Specifies the display unit as degree (°).
RAD	Specifies the display unit as radian.

Query response

{DEG|RAD}<newline><^END>

Related commands

CALC{1-5}:FORM command on page 298

Front Panel Equivalents

Meas/Formet - **Meas/Format...** - Phase Unit [Degree/Radian]

CALC{1-5}:MARK{1-8}

Format

CALCulate{1-5}:MARKer{1-8}[:STATe] {ON|OFF|1|0}

CALCulate{1-5}:MARKer{1-8}[:STATe]?

Description

Turns on/off markers 1-8.

In addition, use the **CALC{1-5}:MARK:REF** command to turn on/off the reference marker.

Also, use the **CALC{1-5}:MARK:AOFF** command to simultaneously turn off all of the markers displayed on the trace.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).
MARKer{1-8}	Specifies the marker number (1 to 8).

	Description
ON or 1	Turns on the marker.
OFF or 0 (Default)	Turns off the marker.

Query response

{1|0}<newline><^END>

Related commands

CALC{1-5}:MARK:REF command on page 328

CALC{1-5}:MARK:AOFF command on page 305

Front Panel Equivalents

Marker - **Marker...** - Select Marker

Marker - **Marker...** - Selected Marker [On/Off]

CALC{1-5}:MARK{1-8}:ACT

Format

CALCulate{1-5}:MARKer{1-8}:ACTivate

Description

Sets the specified marker to the active marker. (No query)

In addition, use the **CALC{1-5}:MARK:REF:ACT** command to set the reference marker to the active marker.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).
MARKer{1-8}	Specifies the marker number (1 to 8).

Related commands

CALC{1-5}:MARK:REF:ACT command on page 329

Front Panel Equivalents

Marker - **Marker...** - Select Marker

Alternatively, click on the specified marker directly.

CALC{1-5}:MARK:AOFF

Format

CALCulate{1-5}:MARKer:AOFF

Description

Turns off all markers displayed on the trace. (No query)

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

Related commands

CALC{1-5}:MARK{1-8} command on page 304

CALC{1-5}:MARK:REF command on page 328

Front Panel Equivalents

Marker - **All Off**

CALC{1-5}:MARK:APE:SET

Format

CALCulate{1-5}:MARKer:APEak:SET

Description

Sets the ΔX and ΔY values of peak definition so that the active marker position is recognized as the peak. Therefore, ΔX is set to the stimulus value difference between the active marker and the adjacent left measurement point, while ΔY is set to the measurement value difference between them. When the Δ mode is set to on, ΔX and ΔY are set to the differences in the stimulus values and the measurement values between the reference marker and the active marker, respectively. (No query)

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

Related commands

CALC{1-5}:MARK:APE:EXC:X command on page 307

CALC{1-5}:MARK:APE:EXC:Y command on page 308

Front Panel Equivalents

Marker - **Function...** - Search Def & Range Menu - Marker to Peak Delta

CALC{1-5}:MARK:APE:EXC:X

Format

CALCulate{1-5}:MARKer:APEak:EXCursion:X <numeric>

CALCulate{1-5}:MARKer:APEak:EXCursion:X?

Description

Sets the ΔX value to define the peak in the marker peak search function.

In addition, use the **CALC{1-5}:MARK:APE:EXC:Y** command to set the ΔY value.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	<numeric>	
Description	ΔX value	
Data type	Floating point	
Range	0 to 3E9 0 to 41 0 to 502E-3 0 to 10E-3 0 to 80 0 to 100E-3	Frequency sweep Oscillator power level sweep Oscillator voltage level sweep Oscillator current level sweep dc bias voltage sweep dc bias current sweep
Default	10E6	
Unit	Variable depending on the sweep parameter.	

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

CALC{1-5}:MARK:APE:EXC:Y command on page 308

CALC{1-5}:MARK:APE:SET command on page 306

Front Panel Equivalents

Marker - **Function...** - Search Def & Range Menu - Peak Delta X

CALC{1-5}:MARK:APE:EXC:Y

Format

CALCulate{1-5}:MARKer:APEak:EXCursion:Y <numeric>

CALCulate{1-5}:MARKer:APEak:EXCursion:Y?

Description

Sets the ΔY value to define the peak in the marker peak search function.

In addition, use the **CALC{1-5}:MARK:APE:EXC:X** command to set the ΔX value.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	<numeric>
Description	ΔY value
Data type	Floating point
Range	0 to 100E6
Default	1
Unit	Variable depending on the measurement parameter.

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

CALC{1-5}:MARK:APE:EXC:X command on page 307

CALC{1-5}:MARK:APE:SET command on page 306

Front Panel Equivalents

Marker - **Function...** - Search Def & Range Menu - Peak Delta Y

CALC:MARK:COUP

Format

CALCulate:MARKer:COUPle {ON|OFF|1|0}

CALCulate:MARKer:COUPle?

Description

As the marker movement setting, selects either the mode in which the markers on all traces are coupled when moved (coupled marker mode) or the mode in which the markers on the differernt traces are moved separately (uncoupled marker mode).

If the markers on other traces are at different positions than that of the marker on the active trace, they are moved when the mode is changed from the uncoupled marker mode to the coupled marker mode.

Parameters

	Description
ON or 1 (Default)	Specifies the coupled marker mode.
OFF or 0	Specifies the uncoupled marker mode.

Query response

{1|0}<newline><^END>

Front Panel Equivalents

Marker - **Marker...** - More - Coupled Marker: [On/Off]

CALC{1-5}:MARK:DISC

Format

CALCulate{1-5}:MARKer:DISCrete {ON|OFF|1|0}

CALCulate{1-5}:MARKer:DISCrete?

Description

Switches between the continuous marker mode (marker movable throughout the range defined by the measurement points) and the discrete marker mode (marker movable only to the measurement points).

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
ON or 1	Specifies the discrete marker mode.
OFF or 0 (Default)	Specifies the continuous marker mode.

Query response

{1|0}<newline><^END>

Front Panel Equivalents

Marker - **Marker...** - More - Marker: [Continuous/Discrete]

CALC{4-5}:MARK:FORM

Format

CALCulate{4-5}:MARKer:FORMat
{REALIMAG|LINMAGPHASE|LOGMAGPHASE|RX|GB|SWRPHASE}

CALCulate{4-5}:MARKer:FORMat?

Description

Specifies the format for reading the marker position measurement value when the complex trace is displayed.

In addition, use the **CALC{1-5}:MARK{1-8}:Y?** command or the **CALC{1-5}:MARK:REF:Y** command to read the measurement value at the marker position.

Parameters

Sub-block	Description
CALCulate{4-5}	Specifies the trace number (4 to 5).

	Description
REALIMAG	Real part and imaginary part of the complex number
LINMAGPHASE (Default)	Linear amplitude and phase
LOGMAGPHASE	Logarithmic amplitude and phase
RX	Complex impedance
GB	Complex admittance
SWRPHASE	SWR (Standing Wave Ratio) and phase

Query response

{REALIMAG|LINMAGPHASE|LOGMAGPHASE|RX|GB|SWRPHASE}<newline><^END>

Related commands

CALC{1-5}:MARK{1-8}:Y? command on page 339

CALC{1-5}:MARK:REF:Y command on page 335

Front Panel Equivalents

Marker - **Fctn More...** - Smith/Polar

CALC{1-5}:MARK:FUNC

Format

CALCulate{1-5}:MARKer:FUNCtion[:SELect]
{MAXimum|MINimum|PPEak|NPEak|TARget}

CALCulate{1-5}:MARKer:FUNCtion[:SELect]?

Description

Specifies the marker search function. Executing this command only selects the search function but does not perform the marker search. To execute the marker search, it is necessary to also set on the search tracking function by executing the **CALC{1-5}:MARK:FUNC:EXEC** command or the **CALC{1-5}:MARK:FUNC:TRAC** command.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
MAXimum (Default)	Specifies the maximum search.
MINimum	Specifies the minimum search.
PPEak	Specifies the positive peak search.
NPEak	Specifies the negative peak search.
TARget	Specifies the target search.

Query response

{MAX|MIN|PPE|NPE|TAR}<newline><^END>

Related commands

CALC{1-5}:MARK:FUNC:EXEC command on page 321

CALC{1-5}:MARK:FUNC:TRAC command on page 325

Front Panel Equivalents

Marker - **Function...** - Search Type

CALC{1-5}:MARK:FUNC:DOM

Format

CALCulate{1-5}:MARKer:FUNCtion:DOMain[:STATe] {ON|OFF|1|0}

CALCulate{1-5}:MARKer:FUNCtion:DOMain[:STATe]?

Description

Turns on/off the partial search function of the marker search function.

In addition, use the **CALC{1-5}:MARK:FUNC:DOM:STAR** command and the **CALC{1-5}:MARK:FUNC:DOM:STOP** command or the **CALC{1-5}:MARK:FUNC:DOM:SPAN** command to set the partial search range line.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
ON or 1	Turns on the partial search function.
OFF or 0 (Default)	Turns off the partial search function.

Query response

{1|0}<newline><^END>

Related commands

CALC{1-5}:MARK:FUNC:DOM:STAR command on page 320

CALC{1-5}:MARK:FUNC:DOM:STOP command on page 320

CALC{1-5}:MARK:FUNC:DOM:SPAN command on page 319

Front Panel Equivalents

Marker - **Function...** - Search Def & Range Menu - Partial Search: [On/Off]

CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM

Format

CALCulate{1-5}:MARKer{1-8}:FUNCtion:DOMain:LIMit[:STATe] {ON|OFF|1|0}

CALCulate{1-5}:MARKer{1-8}:FUNCtion:DOMain:LIMit[:STATe]?

Description

Selects whether to set the specified marker as the test marker when using the limit test function.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).
MARKer{1-8}	Specifies the marker number (1 to 8).

	Description
ON or 1	Sets the specified marker as the test marker.
OFF or 0 (Default)	Does not set the specified marker as the test marker.

Query response

{1|0}<newline><^END>

Related commands

CALC{1-5}:MARK:REF:FUNC:DOM:LIM command on page 329

Front Panel Equivalents

Marker - **Limit...** - Test Marker: [On/Off]

CALC{1-5}:MARK:FUNC:DOM:LIM:ALL

Format

CALCulate{1-5}:MARKer:FUNCtion:DOMain:LIMit:ALL[:STATe] {ON|OFF|1|0}

CALCulate{1-5}:MARKer:FUNCtion:DOMain:LIMit:ALL[:STATe]?

Description

Turns on/off the marker limit test function.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
ON or 1	Turns on the marker limit test function.
OFF or 0 (Default)	Turns off the marker limit test function.

Query response

{1|0}<newline><^END>

Related commands

CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM command on page 313

CALC{1-5}:MARK:REF:FUNC:DOM:LIM command on page 329

Front Panel Equivalents

Marker - **Limit...** - Limit Test: [On/Off]

CALC{1-5}:MARK:FUNC:DOM:LIM:ALL:RES?

Format

CALCulate{1-5}:MARKer:FUNCtion:DOMain:LIMit:ALL:RESult?

Description

Returns the limit test result (logical conjunction of all test results of every test marker operated by AND) at all test marker positions. (Query only)

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

Query response

{PASS|FAIL|NONE}<newline><^END>

	Description
PASS	Passed
FAIL	Failed
NONE	No limit test is executed.

Related commands

CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:RES? command on page 317

CALC{1-5}:MARK:REF:FUNC:DOM:LIM:RES? command on page 331

Front Panel Equivalents

Unavailable.

CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:LOW

Format

CALCulate{1-5}:MARKer{1-8}:FUNCtion:DOMain:LIMit:LOWer <numeric>

CALCulate{1-5}:MARKer{1-8}:FUNCtion:DOMain:LIMit:LOWer?

Description

Sets the lower test limit value at the specified marker position when using the limit test function.

In addition, use the **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:UP** command to set the upper test limit value.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).
MARKer{1-8}	Specifies the marker number (1 to 8).

	<numeric>
Description	Lower test limit value
Data type	Floating point
Range	-1E12 to 1E12
Default	0
Unit	Variable depending on the measurement parameter.

Query response

{numeric}<newline><^END>

Related commands

CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:UP command on page 318

Front Panel Equivalents

Marker - **Limit...** - Lower

CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:RES?

Format CALCulate{1-5}:MARKer{1-8}:FUNCtion:DOMain:LIMit:RESult?

Description Returns the limit test result at the specified marker position. (Query only)

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).
MARKer{1-8}	Specifies the marker number (1 to 8).

Query response {PASS|FAIL|NONE}<newline><^END>

	Description
PASS	Passed
FAIL	Failed
NONE	No limit test is executed.

Related commands **CALC{1-5}:MARK:REF:FUNC:DOM:LIM:RES?** command on page 331

CALC{1-5}:MARK:FUNC:DOM:LIM:ALL:RES? command on page 315

Front Panel Equivalents Unavailable.

CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:UP

Format

CALCulate{1-5}:MARKer{1-8}:FUNCtion:DOMain:LIMit:UPper <numeric>

CALCulate{1-5}:MARKer{1-8}:FUNCtion:DOMain:LIMit:UPper?

Description

Sets the upper test limit value at the specified marker position when using the limit test function.

In addition, use the **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:LOW** command to set the lower test limit value.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).
MARKer{1-8}	Specifies the marker number (1 to 8).

	<numeric>
Description	Upper test limit value
Data type	Floating point
Range	-1E12 to 1E12
Default	0
Unit	Variable depending on the sweep parameter.

Query response

{numeric}<newline><^END>

Related commands

CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:LOW command on page 316

Front Panel Equivalents

Marker - **Limit...** - Upper

CALC{1-5}:MARK:FUNC:DOM:SPAN

Format

CALCulate{1-5}:MARKer:FUNCtion:DOMain:SPAN

CALCulate{1-5}:MARKer:FUNCtion:DOMain:SPAN?

Description

If the reference marker is set to on, sets the marker partial search range using the span of the reference marker and the active marker. The span value in the partial search range is read when executing the command by query.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

Query response

{numeric}<newline><^END>

It is read in the floating-point value.

Related commands

CALC{1-5}:MARK:FUNC:DOM command on page 312

Front Panel Equivalents

Marker - **Function...** - Search Def & Range Menu - Mkr Delta to Search Range

CALC{1-5}:MARK:FUNC:DOM:STAR

Format

CALCulate{1-5}:MARKer:FUNCtion:DOMain:STARt

CALCulate{1-5}:MARKer:FUNCtion:DOMain:STARt?

Description

Sets the stimulus value of the active marker position on the left range line of the marker partial search range. This left range line is read when executing the command by query.

In addition, use the **CALC{1-5}:MARK:FUNC:DOM:STOP** command to set the right range line.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

Query response

{numeric}<newline><^END>

Related commands

CALC{1-5}:MARK:FUNC:DOM command on page 312

CALC{1-5}:MARK:FUNC:DOM:STOP command on page 320

Front Panel Equivalents

Marker - **Function...** - Search Def & Range Menu - Marker to left Range

CALC{1-5}:MARK:FUNC:DOM:STOP

Format

CALCulate{1-5}:MARKer:FUNCtion:DOMain:STOP

CALCulate{1-5}:MARKer:FUNCtion:DOMain:STOP?

Description

Sets the stimulus value of the active marker position on the right range line of the marker partial search range. This right range line is read when executing the command by query.

In addition, use the **CALC{1-5}:MARK:FUNC:DOM:STAR** command to set the left range line.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

Query response

{numeric}<newline><^END>

Related commands

CALC{1-5}:MARK:FUNC:DOM command on page 312

CALC{1-5}:MARK:FUNC:DOM:STAR command on page 320

Front Panel Equivalents

Marker - **Function...** - Search Def & Range Menu - Marker to Right Range

CALC{1-5}:MARK:FUNC:EXEC

Format

CALCulate{1-5}:MARKer:FUNCtion:EXECute
[MAXimum|MINimum|PPEak|NPEak|TARget]

Description

Executes the marker search only once. (No query)

In addition, set on the search tracking function with the **CALC{1-5}:MARK:FUNC:TRAC** command after selecting the search function with the **CALC{1-5}:MARK:FUNC** command when you want to repeatedly execute the marker search at every sweep.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
MAXimum	Searches the maximum value.
MINimum	Searches the minimum value.
PPEak	Searches the positive peak.
NPEak	Searches the negative peak.
TARget	Searches the target.

The parameter selection (search function) can be omitted. In this case, the marker search is executed by the search function selected with the **CALC{1-5}:MARK:FUNC** command.

Related commands

CALC{1-5}:MARK:FUNC command on page 311

CALC{1-5}:MARK:FUNC:TRAC command on page 325

Front Panel Equivalents

Marker - **Function...** - Search Type, and

Marker - **Function...** - Search

CALC{1-5}:MARK:FUNC:EXEC:LEFT

Format

CALCulate{1-5}:MARKer:FUNCtion:EXECute:LEFT

Description

Searches the peak/target on the left side of the active marker in the marker search function. Before executing this command, it is necessary to set the search objective (positive peak/negative peak/target) with the **CALC{1-5}:MARK:FUNC** command. (No query)

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

Related commands

CALC{1-5}:MARK:FUNC command on page 311

CALC{1-5}:MARK:FUNC:EXEC:RIGH command on page 323

CALC{1-5}:MARK:FUNC:EXEC:NEXT command on page 322

Front Panel Equivalents

Marker - **Function...** - Left

CALC{1-5}:MARK:FUNC:EXEC:NEXT

Format

CALCulate{1-5}:MARKer:FUNCtion:EXECute:NEXT

Description

Searches the largest peak next to the most recently searched peak in the marker search function. Before executing this command, it is necessary to set the search objective (positive peak/negative peak) with the **CALC{1-5}:MARK:FUNC** command. (No query)

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

Related commands

CALC{1-5}:MARK:FUNC command on page 311

CALC{1-5}:MARK:FUNC:EXEC:LEFT command on page 322

CALC{1-5}:MARK:FUNC:EXEC:RIGH command on page 323

Front Panel Equivalents

Marker - **Function...** - Next

CALC{1-5}:MARK:FUNC:EXEC:RIGH

Format

CALCulate{1-5}:MARKer:FUNCtion:EXECute:RIGHt

Description

Searches the peak/target on the right side of the active marker in the marker search function. Before executing this command, it is necessary to set the search objective (positive peak/negative peak/target) with the **CALC{1-5}:MARK:FUNC** command. (No query)

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

Related commands

CALC{1-5}:MARK:FUNC command on page 311

CALC{1-5}:MARK:FUNC:EXEC:LEFT command on page 322

CALC{1-5}:MARK:FUNC:EXEC:NEXT command on page 322

Front Panel Equivalents

Marker - **Function...** - Right

CALC{1-5}:MARK:FUNC:TARG

Format

CALCulate{1-5}:MARKer:FUNCtion:TARGet <numeric>

CALCulate{1-5}:MARKer:FUNCtion:TARGet?

Description

Sets the target value to perform the target search with the **CALC{1-5}:MARK:FUNC** command or the **CALC{1-5}:MARK:FUNC:EXEC** command in the marker search. Use the relative value from the reference marker to set the target value because the set value is used as the relative value from the reference value in the Δ mode.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	<numeric>
Description	Target value
Data type	Floating point
Range	same Y-axis scale range
Default	0
Unit	Variable depending on the measurement parameter.

Query response

{numeric}<newline><^END>

Related commands

CALC{1-5}:MARK:FUNC command on page 311

CALC{1-5}:MARK:FUNC:EXEC command on page 321

Front Panel Equivalents

Marker - **Function...** - Search Def & Range Menu - Target Value

CALC{1-5}:MARK:FUNC:TRAC

Format

CALCulate{1-5}:MARKer:FUNCtion:TRACking {ON|OFF|1|0}

CALCulate{1-5}:MARKer:FUNCtion:TRACking?

Description

Turns on/off the marker search tracking function. Setting on the search tracking automatically executes the marker search for the search function selected with the **CALC{1-5}:MARK:FUNC** command for every sweep.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
ON or 1	Turns on the marker search tracking function.
OFF or 0 (Default)	Turns off the marker search tracking function.

Query response

{1|0}<newline><^END>

Related commands

CALC{1-5}:MARK:FUNC command on page 311

Front Panel Equivalents

Marker - **Function...** - Search Track [On/Off]

CALC{1-5}:MARK:LIST

Format

CALCulate{1-5}:MARKer:LIST {ON|OFF|1|0}

CALCulate{1-5}:MARKer:LIST?

Description

Displays the marker list.

In addition, it is necessary to set the specified trace to the active trace with the **DISP:TRAC{1-5}:SEL** command when you want to display the marker list.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
ON or 1	Displays the marker list.
OFF or 0 (Default)	Does not display the marker list.

Query response

{1|0}<newline><^END>

Related commands

DISP:TRAC{1-5}:SEL command on page 358

Front Panel Equivalents

Marker - **Fctn More...** - Marker List [On/Off]

CALC{1-5}:MARK:ON

Format

CALCulate{1-5}:MARKer:ON {DATA|MEMory}

CALCulate{1-5}:MARKer:ON?

Description

Selects the trace to display the marker.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
DATA (Default)	Displays the marker on the data trace.
MEMory*1	Displays the marker on the memory trace.

*1. Can be selected with the **CALC{1-5}:MATH:FUNC** command when the memory trace is displayed on the screen.

Query response

{DATA|MEM}<newline><^END>

Related commands

CALC{1-5}:MATH:FUNC command on page 340

Front Panel Equivalents

Marker - **Marker...** - Marker On [Data/Memory]

CALC{1-5}:MARK:REF

Format

CALCulate{1-5}:MARKer:REFerence[:STATe] {ON|OFF|1|0}

CALCulate{1-5}:MARKer:REFerence[:STATe]?

Description

Turns on/off the reference marker (marker R). However, only displaying the reference marker does not set on the Δ mode for using the reference marker in Δ mode. Use the **CALC{1-5}:MARK:REF:TYPE** command to turn on the Δ mode.

In addition, use the **CALC{1-5}:MARK{1-8}** command to turn on/off markers 1-8.

Also, use the **CALC{1-5}:MARK:AOFF** command to turn off all of the markers on the specified trace.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
ON or 1	Turns on the reference marker.
OFF or 0 (Default)	Turns off the reference marker.

Query response

{1|0}<newline><^END>

Related commands

CALC{1-5}:MARK:REF:TYPE command on page 333

CALC{1-5}:MARK{1-8} command on page 304

CALC{1-5}:MARK:AOFF command on page 305

Front Panel Equivalents

Marker - **Marker...** - Select Marker (Specifies the marker R)

Marker - **Marker...** - Selected Marker [On/Off]

CALC{1-5}:MARK:REF:ACT

Format

CALCulate{1-5}:MARKer:REFerence:ACTivate

Description

Sets the reference marker to the active marker. (No query)

In addition, use the **CALC{1-5}:MARK{1-8}:ACT** command to set markers 1-8 to the active marker.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

Related commands

CALC{1-5}:MARK{1-8}:ACT command on page 305

Front Panel Equivalents

Marker - **Marker...** - Select Marker (Specifies the marker R)

Alternatively, click on the reference marker directly.

CALC{1-5}:MARK:REF:FUNC:DOM:LIM

Format

CALCulate{1-5}:MARKer:REFerence:FUNCtion:DOMain:LIMit[:STATe] {ON|OFF|1|0}

CALCulate{1-5}:MARKer:REFerence:FUNCtion:DOMain:LIMit[:STATe]?

Description

Selects whether to set the reference marker as the test marker when using the limit test function.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
ON or 1	Sets the reference marker as the test marker.
OFF or 0 (Default)	Does not set the reference marker as the test marker.

Query response

{1|0}<newline><^END>

Front Panel Equivalents

Marker - **Limit...** - Test Marker [On/Off]

CALC{1-5}:MARK:REF:FUNC:DOM:LIM:LOW

Format

CALCulate{1-5}:MARKer:REFerence:FUNCtion:DOMain:LIMit:LOWer <numeric>

CALCulate{1-5}:MARKer:REFerence:FUNCtion:DOMain:LIMit:LOWer?

Description

Sets the lower test limit value at the reference marker position when using the limit test function.

In addition, use the **CALC{1-5}:MARK:REF:FUNC:DOM:LIM:UP** command to set the upper test limit value.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	<numeric>
Description	Lower test limit value
Data type	Floating point
Range	-1E12 to 1E12
Default	0
Unit	Variable depending on the measurement parameter.

Query response

{numeric}<newline><^END>

Related commands

CALC{1-5}:MARK:REF:FUNC:DOM:LIM:UP command on page 332

Front Panel Equivalents

Marker - **Limit...** - Lower

CALC{1-5}:MARK:REF:FUNC:DOM:LIM:RES?

Format CALCulate{1-5}:MARKer:REFerence:FUNCtion:DOMain:LIMit:RESult?

Description Returns the limit test result at the reference marker position. (Query only)

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

Query response {PASS|FAIL|NONE}<newline><^END>

	Description
PASS	Passed
FAIL	Failed
NONE	No limit test is executed.

Related commands **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:RES?** command on page 317

CALC{1-5}:MARK:FUNC:DOM:LIM:ALL:RES? command on page 315

Front Panel Equivalents Unavailable.

CALC{1-5}:MARK:REF:FUNC:DOM:LIM:UP

Format

CALCulate{1-5}:MARKer:REFerence:FUNCtion:DOMain:LIMit:UPper <numeric>

CALCulate{1-5}:MARKer:REFerence:FUNCtion:DOMain:LIMit:UPper?

Description

Sets the upper test limit value at the reference marker position when using the limit test function.

In addition, use the **CALC{1-5}:MARK:REF:FUNC:DOM:LIM:LOW** command to set the lower test limit value.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	<numeric>
Description	Upper test limit value
Data type	Floating point
Range	-1E12 to 1E12
Default	0
Unit	Variable depending on the measurement parameter.

Query response

{numeric}<newline><^END>

Related commands

CALC{1-5}:MARK:REF:FUNC:DOM:LIM:LOW command on page 330

Front Panel Equivalents

Marker - **Limit...** - Upper

CALC{1-5}:MARK:REF:TYPE

Format

CALCulate{1-5}:MARKer:REFerence:TYPE {OFF|DELTA|FIXDELTA}

CALCulate{1-5}:MARKer:REFerence:TYPE?

Description

Selects the type of reference marker (marker R).

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
OFF (Default)	Sets the Δ mode to off.
DELTA	Sets the Δ mode to on. At this time, the reference marker is fixed at the position of the current stimulus value. The reference marker moves in accordance with the measurement value variation of the specified stimulus value during the measurement.
FIXDELTA	Sets the Δ mode to on. At this time, the reference marker is fixed at the position of the current stimulus value and measurement value. The reference marker is fixed during the measurement regardless of the measurement value variation.

Query response

{OFF|DELTA|FIXDELTA}<newline><^END>

Front Panel Equivalents

Marker - **Marker...** - Delta Marker Menu - Delta Mode

CALC{1-5}:MARK:REF:X

Format

CALCulate{1-5}:MARKer:REFerence:X <numeric>

CALCulate{1-5}:MARKer:REFerence:X?

Description

Moves the reference marker (marker R) to the position of the stimulus value specified on the trace. The stimulus value at the reference marker position is read when executing the command by query.

In addition, use the **CALC{1-5}:MARK:REF:Y** command to read the measurement value at the reference marker position.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	<numeric>
Description	Sets the stimulus value (or sets the measurement point, if the stimulus range is set to zero span and marker x-axis unit is set to time) at the marker position
Data type	Floating point
Range	Variable depending on the marker x-axis unit and sweep parameter.
Default	Variable depending on the marker x-axis unit and sweep parameter.
Unit	Variable depending on the marker x-axis unit and sweep parameter.

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

CALC{1-5}:MARK:REF:Y command on page 335

Front Panel Equivalents

Marker - **Marker...** - Select Marker (Specifies marker R)

Marker - **Marker...** - Stimulus

CALC{1-5}:MARK:REF:Y

Format

CALCulate{1-5}:MARKer:REFerence:Y <numeric 1>,<numeric 2>

CALCulate{1-5}:MARKer:REFerence:Y?

Description

Moves the reference marker (marker R) to the specified measurement value when the Δ mode is set to fixed Δ. In addition, use the **CALC{1-5}:MARK:REF:X** command to move the reference marker position to the specified stimulus value.

Parameters

- With scalar trace:

Sub-block	Description
CALCulate{1-3}	Specifies the trace number (1 to 3).

	<numeric 1>	<numeric 2>
Description	Measurement value in the real number type	Always 0
Data type	Floating point	
Range	-1E12 to 1E12	
Default	Variable depending on the sweep parameter.	0
Unit		None

- With complex trace:

Sub-block	Description
CALCulate{4-5}	Specifies the trace number (4 to 5).

	<numeric 1>	<numeric 2>
Description	Real part of measurement value (complex type)	Imaginary part of measurement value (complex type)
Data type	Floating point	
Range	-1E12 to 1E12	
Default	Variable depending on the sweep parameter.	
Unit		

Query response

{numeric 1}, {numeric 2}<newline><^END>

Related commands

CALC{1-5}:MARK:REF:TYPE command on page 333

CALC{1-5}:MARK{1-8}:X command on page 338

Front Panel Equivalents

Marker - **Marker...** - Delta Marker Menu - Delta Value|Delta Aux Value

CALC{1-5}:MARK:SET

Format

CALCulate{1-5}:MARKer:SET
{CENTer|DELTASPAN|STARt|STOP|REFerence|OFFSet}

Description

Performs the E4991A's settings by using the stimulus/measurement value at the active marker positions. (No query)

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
CENTer	Sets the stimulus value at the active marker position to the center value in the sweep range.
DELTASPAN*1	Sets the area where the active marker and reference marker are placed to the span value in the sweep range.
STARt	Sets the stimulus value at the active marker position to the start value in the sweep range.
STOP	Sets the stimulus value at the active marker position to the stop value in the sweep range.
REFerence*2	Sets the measurement value at the active marker position to the reference value on the Y-axis.
OFFSet*3	Sets the measurement value at the active marker position to the offset value to be subtracted from the trace data.

*1. Can be set when the Δ mode is set to on.
*2. Can be set when the display format is the linear Y-axis format or the complex plane format.
*3. Can be set for the scalar trace.

Front Panel Equivalents

Marker - **To...** - Center|DeltaToSpan|Start|Stop|Reference|Offset

CALC{1-5}:MARK:UNIT

Format

CALCulate{1-5}:MARKer:UNIT {SPARameter|TIME|IOMega}

CALCulate{1-5}:MARKer:UNIT?

Description

Specifies the display method of the marker value on the X-axis.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
SPARameter (Default)	Specifies the display for sweep parameter.
TIME	Specifies the display for time (required sweep time from start to end).
IOMega*1	Specifies the display for relaxation time (1/2πf, f: measurement frequency).

*1. Can be set when the sweep parameter is the frequency sweep.

Query response

{SPAR|TIME|IOM}<newline><^END>

Front Panel Equivalents

Marker - **Fctn More...** - Marker X Axis

CALC{1-5}:MARK{1-8}:X

Format

CALCulate{1-5}:MARKer{1-8}:X <numeric>

CALCulate{1-5}:MARKer{1-8}:X?

Description

Moves the marker to the stimulus value specified on the trace. The stimulus value at the marker position is read when executing the command by query.

In addition, when the Δ mode is set to on and this command is executed by query, the stimulus value at the marker position is read in the form of a relative value to the reference marker

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).
MARKer{1-8}	Specifies the marker number (1 to 8)

	<numeric>
Description	Sets the stimulus value (or sets measurement point if the stimulus range is set to zero span and marker x-axis unit is set to time) at the marker position.
Data type	Floating point
Range	Variable depending on the marker x-axis unit and sweep parameter.
Default	Variable depending on the marker x-axis unit and sweep parameter.
Unit	Variable depending on the marker x-axis unit and sweep parameter.

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

CALC{1-5}:MARK{1-8}:Y? command on page 339

Front Panel Equivalents

Marker - **Marker...** - Select Marker (Specifies the marker 1-8)

Marker - **Marker...** - Stimulus

CALC{1-5}:MARK{1-8}:Y?

Format

CALCulate{1-5}:MARKer{1-8}:Y?

Description

Reads the measurement value at the marker position. When the Δ mode is set to on and this command is executed, the measurement value at the marker position is read in the form of a relative value to the reference marker. (Query only)

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).
MARKer{1-8}	Specifies the marker number (1 to 8).

Query response

{numeric 1}, {numeric 2}<newline><^END>

- With complex trace:

	{numeric 1}	{numeric 2}
Description	Real part of measurement value (complex type)	Imaginary part of measurement value (complex type)
Data type	Floating point	

- With scalar trace:

	{numeric 1}	{numeric 2}
Description	Measurement value of real number type	0 is always read.
Data type	Floating point	

Related commands

CALC{1-5}:MARK{1-8}:X command on page 338

Front Panel Equivalents

Unavailable.

CALC{1-5}:MATH:FUNC

Format

CALCulate{1-5}:MATH:FUNCtion {DATA|AND|MEM|DMNM|PER|DDVM}

CALCulate{1-5}:MATH:FUNCtion?

Description

Selects the trace to be displayed.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
DATA (Default)	Displays the data trace.
AND	Displays both the data trace and the memory trace.
MEM	Displays the memory trace.
DMNM	Displays the data trace. The data trace content is the operation result of “DATA - MEM”.
PER*1	Displays the data trace. The data trace content is the operation result of “(DATA - MEM) / MEM × 100(%)”.
DDVM*2	Displays the data trace. The data trace content is the operation result of “DATA / MEM”.

*1. Can be selected for the scalar trace (trace number 1, 2, or 3)
*2. Can be selected for the complex trace (trace number 4 or 5)

The memory trace can be displayed when the data trace is copied to the memory trace using the **CALC{1-5}:MATH:MEM** command or the frequency characteristic is simulated in the equivalent circuit analysis using the **CALC{1-5}:EPAR:SIM** command.

Query response

{DATA|AND|MEM|DMNM|PER|DDVM}<newline><^END>

Related commands

CALC{1-5}:MATH:MEM command on page 341

CALC{1-5}:EPAR:SIM command on page 297

Front Panel Equivalents

Display - **Display...** - Define Trace

CALC{1-5}:MATH:MEM

Format

CALCulate{1-5}:MATH:MEMorize

Description

Copies the data trace to the memory trace. (No query)

In addition, use the **CALC{1-5}:MATH:FUNC** command to display the memory trace. And, use the **CALC{1-5}:DATA?** command to read the memory trace content.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

Related commands

CALC{1-5}:MATH:FUNC command on page 340

CALC{1-5}:DATA? command on page 293

Front Panel Equivalents

Display - **Display...** - Copy Data -> Memory

CALC{1-3}:MATH:OFFS

Format

CALCulate{1-3}:MATH:OFFSet <numeric>

CALCulate{1-3}:MATH:OFFSet?

Description

Sets the offset value to be subtracted from the data trace for the scalar trace.

Parameters

Sub-block	Description
CALCulate{1-3}	Specifies the trace number (1 to 3).

	<numeric>
Description	Offset value
Data type	Floating point
Range	same Y-axis scale range
Default	0
Unit	Variable depending on the measurement parameter.

Query response

{numeric}<newline><^END>

Front Panel Equivalents

Display - **Display...** - Math Offset

CALC{1-5}:MST

Format

CALCulate{1-5}[:EVALuate]:MSTatistics[:STATe] {ON|OFF|1|0}

CALCulate{1-5}[:EVALuate]:MSTatistics[:STATe]?

Description

Displays the statistical analysis results. Statistical values (average value, standard deviation, difference between maximum value and minimum value) in the marker partial search range are calculated and displayed at every sweep completion. When the marker display is set to off, no statistical analysis results are displayed. In addition, when the marker partial search range is not set on with the **CALC{1-5}:MARK:FUNC:DOM** command, the statistical values in all sweep ranges are calculated and displayed.

It is necessary to set markers on with the **CALC{1-5}:MARK{1-8}** command or the **CALC{1-5}:MARK:REF** command when you want to display the statistical analysis results.

In addition, use the **CALC{1-5}:MST:DATA?** command to read the statistical value.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
ON or 1	Displays the statistical analysis result.
OFF or 0 (Default)	Does not display the statistical analysis result.

Query response

{1|0}<newline><^END>

Related commands

CALC{1-5}:MST:DATA? command on page 344

CALC{1-5}:MARK{1-8} command on page 304

CALC{1-5}:MARK:REF command on page 328

CALC{1-5}:MARK:FUNC:DOM command on page 312

Front Panel Equivalents

Marker - **Fctn More...** - Statistics [On/Off]

CALC{1-5}:MST:DATA?

Format

CALCulate{1-5}[:EVALuate]:MSTatistics:DATA? {MEAN|SDEV|PEAK}

Description

Reads the statistical analysis result. (Query only)

In addition, use the **CALC{1-5}:MST** command to turn on/off the statistical analysis function.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	Description
MEAN	Specifies the average value.
SDEV	Specifies the standard deviation.
PEAK	Specifies the difference between maximum value and minimum (peak-to-peak) value.

Query response

{numeric}<newline><^END>

It is read in the floating-point value.

Related commands

CALC{1-5}:MST command on page 343

Front Panel Equivalents

Unavailable.

DATA:CAD{1-8}?

Format

DATA[:DATA]:CAD{1-8}?

Description

Reads the calibration data array. (Query only)

NOTE

This command can be used to read a calibration data array that is measured with the calibration data measurement points of “User-defined frequency points” or “User-defined power points.”

Parameters

The calibration data arrays include a total of eight standard measurement data (two measurements each) of Open/Short/Load/Low-loss capacitor. CAD1 to CAD8 correspond to these data arrays.

Sub-block	Description
CAD1	Specifies the first Open calibration data array.
CAD2	Specifies the first Short calibration data array.
CAD3	Specifies the first Load calibration data array.
CAD4	Specifies the first Low-loss capacitor calibration data array.
CAD5	Specifies the second Open calibration data array.
CAD6	Specifies the second Short calibration data array.
CAD7	Specifies the second Load calibration data array.
CAD8	Specifies the second Low-loss capacitor calibration data array.

Query response

{numeric 1}, {numeric 2},.., {numeric N × 2 - 1}, {numeric N × 2}<newline><^END>

	Description
{numeric n × 2 - 1}	Real part of data (complex type) at the n-th measurement point
{numeric n × 2}	Imaginary part of data (complex type) at the n-th measurement point

The data consist of the real and imaginary parts of a complex number. n indicates an integer between 1 and N, where N is the number of measurement points.

It is read in the floating-point value.

Related commands

DATA:SEGM{1-16}:CAD{1-8}? command on page 350

SENS:CORR1:COLL:FPO command on page 438

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

DATA:CCO{1-6}

Format

DATA[:DATA]:CCO{1-6} <numeric 1>,<numeric 2>,..,<numeric N×2-1>,<numeric N×2>

DATA[:DATA]:CCO{1-6}?

Description

Sets the calibration coefficient array for calibration. The calibration coefficient array is read during execution by query.

Parameters

There are a total of six calibration coefficient arrays for each coefficient of A1, B1, C1, A2, B2, and C2. CC01 to CC06 correspond to these data arrays.

Sub-block	Description
CC01	Specifies the calibration coefficient A1 array.
CC02	Specifies the calibration coefficient B1 array.
CC03	Specifies the calibration coefficient C1 array.
CC04	Specifies the calibration coefficient A2 array.
CC05	Specifies the calibration coefficient B2 array.
CC06	Specifies the calibration coefficient C2 array.

	Description
<numeric n × 2 - 1>	Real part of data (complex type) at the n-th measurement point
<numeric n × 2>	Imaginary part of data (complex type) at the n-th measurement point

The data consist of the real and imaginary parts of a complex number. n indicates an integer between 1 and N, where N is the number of measurement points.

It is read in the floating-point value.

Query response

{numeric 1}, {numeric 2},.., {numeric N × 2 - 1}, {numeric N × 2}<newline><^END>

Related commands

DATA:SEGM{1-16}:CCO{1-6} command on page 351

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

DATA:CMD{1-2}?

Format

DATA[:DATA]:CMD{1-2}?

Description

Reads the fixture compensation data array. (Query only)

NOTE

This command can be used to read a fixture compensation data array measured with the fixture compensation data measurement points of “User-defined frequency points” or “User-defined power points.”

Parameters

The fixture compensation data arrays include two standard measurement data of Open/Short. CMD1 and CMD2 correspond to these data arrays.

Sub-block	Description
CMD1	Specifies the Open compensation data array.
CMD2	Specifies the Short compensation data array.

Query response

{numeric 1}, {numeric 2},.., {numeric N × 2 - 1}, {numeric N × 2}<newline><^END>

	Description
{numeric n × 2 - 1}	Real part of data (complex type) at the n-th measurement point
{numeric n × 2}	Imaginary part of data (complex type) at the n-th measurement point

The data consist of the real and imaginary parts of a complex number. n indicates an integer between 1 and N, where N is the number of measurement points.

It is read in the floating-point value.

Related commands

DATA:SEGM{1-16}:CMD{1-2}? command on page 352

SENS:CORR2:COLL:FPO command on page 450

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

DATA:CMP{1-3}

Format

DATA[:DATA]:CMP{1-3} <numeric 1>,<numeric 2>,..,<numeric N×2-1>,<numeric N×2>

DATA[:DATA]:CMP{1-3}?

Description

Sets the fixture compensation coefficient array. The fixture compensation coefficient array is read when executing the command by query.

Parameters

There are three fixture compensation coefficient arrays for the coefficients of A, B, and C. CMP1 to CMP3 correspond to these data arrays.

Sub-block	Description
CMP1	Specifies the fixture compensation coefficient A array.
CMP2	Specifies the fixture compensation coefficient B array.
CMP3	Specifies the fixture compensation coefficient C array.

	Description
<numeric n × 2 - 1>	Real part of data (complex type) at the n-th measurement point
<numeric n × 2>	Imaginary part of data (complex type) at the n-th measurement point

The data consist of the real and imaginary parts of a complex number. n indicates an integer between 1 and N, where N is the number of measurement points.

It is read in the floating-point value.

Query response

{numeric 1}, {numeric 2},.., {numeric N × 2 - 1}, {numeric N × 2}<newline><^END>

Related commands

DATA:SEGM{1-16}:CMP{1-3} command on page 353

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

DATA:RAW?

Format

DATA[:DATA]:RAW?

Description

Reads the raw data array. (Query only)

Query response

{numeric 1}, {numeric 2},.., {numeric N × 2 - 1}, {numeric N × 2}<newline><^END>

	Description
{numeric n × 2 - 1}	Real part of data (complex type) at the n-th measurement point
{numeric n × 2}	Imaginary part of data (complex type) at the n-th measurement point

The data consist of the real and imaginary parts of a complex number. n indicates an integer between 1 and N, where N is the number of measurement points.

It is read in the floating-point value.

Related commands

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

DATA:SEGM{1-16}:CAD{1-8}?

Format

DATA[:DATA]:SEGMent{1-16}:CAD{1-8}?

Description

Reads the calibration data array of the segment sweep. (Query only)

NOTE

This command can be used to read a calibration data array measured with the calibration data measurement points of “User-defined frequency points” or “User-defined power points”

Parameters

The calibration data arrays include a total of eight standard measurement data (two measurements each) of Open/Short/Load/Low-loss capacitor. CAD1 to CAD8 correspond to these data arrays.

Sub-block	Description
SEGMent{1-16}	Specifies the segment number (1 to 16).

Sub-block	Description
CAD1	Specifies the first Open calibration data array.
CAD2	Specifies the first Short calibration data array.
CAD3	Specifies the first Load calibration data array.
CAD4	Specifies the first Low-loss capacitor calibration data array.
CAD5	Specifies the second Open calibration data array.
CAD6	Specifies the second Short calibration data array.
CAD7	Specifies the second Load calibration data array.
CAD8	Specifies the second Low-loss capacitor calibration data array.

Query response

{numeric 1}, {numeric 2},.., {numeric N × 2 - 1}, {numeric N × 2}<newline><^END>

	Description
{numeric n × 2 - 1}	Real part of data (complex type) at the n-th measurement point
{numeric n × 2}	Imaginary part of data (complex type) at the n-th measurement point

The data consist of the real and imaginary parts of a complex number. n indicates an integer between 1 and N, where N is the number of measurement points of the specified segment.

It is read in the floating-point value.

Related commands

DATA:CAD{1-8}? command on page 345

SENS:CORR1:COLL:FPO command on page 438

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

DATA:SEGM{1-16}:CCO{1-6}

Format

DATA[:DATA]:SEGMent{1-16}:CCO{1-6} <numeric 1>,<numeric 2>,..,<numeric N×2-1>,<numeric N×2>

Description

Sets the calibration coefficient array for calibration of the segment sweep. The calibration coefficient array is read when executing by query.

Parameters

There are a total of six calibration coefficient arrays for the coefficients of A1, B1, C1, A2, B2, and C2. CC01 to CC06 correspond to these data arrays.

Sub-block	Description
SEGMent{1-16}	Specifies the segment number (1 to 16).

Sub-block	Description
CC01	Specifies the calibration coefficient A1 array.
CC02	Specifies the calibration coefficient B1 array.
CC03	Specifies the calibration coefficient C1 array.
CC04	Specifies the calibration coefficient A2 array.
CC05	Specifies the calibration coefficient B2 array.
CC06	Specifies the calibration coefficient C2 array.

	Description
<numeric n × 2 - 1>	Real part of data (complex type) at the n-th measurement point
<numeric n × 2>	Imaginary part of data (complex type) at the n-th measurement point

The data consist of the real and imaginary parts of a complex number. n indicates an integer between 1 and N, where N is the number of measurement points of the specified segment.

It is read in the floating-point value.

Query response

{numeric value 1}, {numeric value 2},.., {numeric value N × 2 - 1}, {numeric value N × 2}<newline><^END>

Related commands

DATA:CCO{1-6} command on page 346

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

DATA:SEGM{1-16}:CMD{1-2}?

Format

DATA[:DATA]:SEGMent{1-16}:CMD{1-2}?

Description

Reads the fixture compensation data array of the segment sweep. (Query only)

NOTE

This command can be used to read a fixture compensation data array measured with the fixture compensation data measurement points of “User-defined frequency points” or “User-defined power points”

Parameters

The fixture compensation data arrays include two standard measurement data of Open/Short. CMD1 and CMD2 correspond to these data arrays.

Sub-block	Description
SEGMent{1-16}	Specifies the segment number (1 to 16).

Sub-block	Description
CMD1	Specifies the Open compensation data array.
CMD2	Specifies the Short compensation data array.

Query response

{numeric 1}, {numeric 2},.., {numeric N × 2 - 1}, {numeric N × 2}<newline><^END>

	Description
{numeric n × 2 - 1}	Real part of data (complex type) at the n-th measurement point
{numeric n × 2}	Imaginary part of data (complex type) at the n-th measurement point

The data consist of the real and imaginary parts of a complex number. n indicates an integer between 1 and N, where N is the number of measurement points of the specified segment.

It is read in the floating-point value.

Related commands

DATA:CMD{1-2}? command on page 347

SENS:CORR2:COLL:FPO command on page 450

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

DATA:SEGM{1-16}:CMP{1-3}

Format

DATA[:DATA]:SEGMent{1-16}:CMP{1-3} <numeric 1>,<numeric 2>,..,<numeric N×2-1>,<numeric N×2>

DATA[:DATA]:SEGMent{1-16}:CMP{1-3}?

Description

Sets the fixture compensation coefficient array for the segment sweep. The fixture compensation coefficient array is read when executing by query.

Parameters

There are three fixture compensation coefficient arrays for the coefficients of A, B, and C. CMP1 to CMP3 correspond to these data arrays.

Sub-block	Description
SEGMent{1-16}	Specifies the segment number (1 to 16).

Sub-block	Description
CMP1	Specifies the fixture compensation coefficient A array.
CMP2	Specifies the fixture compensation coefficient B array.
CMP3	Specifies the fixture compensation coefficient C array.

	Description
<numeric n × 2 - 1>	Real part of data (complex type) at the n-th measurement point
<numeric n × 2>	Imaginary part of data (complex type) at the n-th measurement point

The data consist of the real and imaginary parts of a complex number. n indicates an integer between 1 and N, where N is the number of measurement points of the specified segment.

It is read in the floating-point value.

Query response

{numeric 1}, {numeric 2},.., {numeric N × 2 - 1}, {numeric N × 2}<newline><^END>

Related commands

DATA:CMP{1-3} command on page 348

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

DISP:BACK

Format

DISPlay:BACKlight {ON|OFF|1|0}

DISPlay:BACKlight?

Description

Turns on/off the LCD backlight.

Parameters

	Description
ON or 1 (Default)	Turns on the LCD backlight.
OFF or 0	Turns off the LCD backlight.

Query response

{1|0}<newline><^END>

Front Panel Equivalents

Unavailable.

DISP:ENAB

Format

DISPlay:ENABle {ON|OFF|1|0}

DISPlay:ENABle?

Description

Sets whether to update the information shown on the screen. No display information is updated when the command is set to off. However, other operations, e.g. measurement of device under test, are normally performed. Furthermore, the CPU power otherwise allocated to update the display is used for parts inside the instrument other than the display.

When the LCD backlight is set to off with the **DISP:BACK** command, the information on the display is still updated even though it is not visible.

Parameters

	Description
ON or 1 (Default)	Updates the information shown on the screen.
OFF or 0	Does not update the information shown on the screen.

Query response

{1|0}<newline><^END>

Related commands

DISP:BACK command on page 354

Front Panel Equivalents

Unavailable.

DISP:FORM

Format

DISPlay[:WINDow]:FORMat {SPLit|OVERlay}

DISPlay[:WINDow]:FORMat?

Description

When displaying plural scalar traces, selects whether to arrange all displayed traces so that they overlap in a single window screen or so that they are divided and displayed in individual window screens.

Parameters

	Description
SPLit	Divides traces to show them in individual window screens.
OVERlay (Default)	Displays all traces in a single window screen.

Query response

{SPL|OVER}<newline><^END>

Front Panel Equivalents

Display - **Display...** - Display Scalar Trace [Overlay/Split]

DISP:TEXT

Format

DISPlay[:WINDow]:TEXT[:STATe] {ON|OFF|1|0}

DISPlay[:WINDow]:TEXT[:STATe]?

Description

Switches between text display and measurement display.

In addition, use the **DISP:TEXT{1-3}:SET** command to specify the page in the text display.

Parameters

	Description
ON or 1	Shows the text display.
OFF or 0 (Default)	Shows the measurement display.

Related commands

DISP:TEXT{1-3}:SET command on page 356

Front Panel Equivalents

Click on the part of the “<< “ when changing the display from text display screen to measurement display screen

DISP:TEXT{1-3}:SET

Format

DISPlay[:WINDow]:TEXT{1-3}:SET

Description

Displays the text information on the screen. (No query)

Parameters

Sub-block	Description
TEXT1	Specifies the display of segment sweep table.
TEXT2	Specifies the display of setting parameters.
TEXT3	Specifies the display of limit test menu.

Related commands

DISP:TEXT command on page 355

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu

Display - **Display...** - More - Operation Param Menu

Marker - **Limit...**

DISP:TRAC{1-5}

Format

DISPlay[:WINDow]:TRACe{1-5}[:STATe] {ON|OFF|1|0}

DISPlay[:WINDow]:TRACe{1-5}[:STATe]?

Description

Turns on/off the specified trace.

Parameters

Sub-block	Description
TRACe{1-5}	Specifies the trace number (1 to 5)

	Description
ON or 1 (Default: Trace 1,2)	Turns on the trace.
OFF or 0 (Default: Trace 3,4,5)	Turns off the trace.

Query response

{1|0}<newline><^END>

Front Panel Equivalents

Display - **Display...** - Num Of Traces

However, only specifying the trace number cannot set the trace to on.

DISP:TRAC{1-5}:GRAT:FORM

Format

DISPlay[:WINDow]:TRACe{1-5}:GRATicule:FORMat
{RECTangle|POLar|SMITh|ADMittance|CPLane}

DISPlay[:WINDow]:TRACe{1-5}:GRATicule:FORMat?

Description

Selects the trace display format.

Parameters

The following display formats can be selected:

- Display format that can be selected for the scalar trace:

Sub-block	Description
TRACe{1-3}	Specifies the trace number (1 to 3)

	Description
RECTangle	Specifies the rectangle format (use the **DISP:TRAC{1-3}:Y:SPAC** command to set the linear/log Y-axis format for the rectangle format)

- Display format that can be selected for the complex trace:

Sub-block	Description
TRACe{4-5}	Specifies the trace number (4 to 5)

	Description
POLar (Default)	Specifies the polar format
SMITh	Specifies the Smith chart format
ADMittance	Specifies the admittance chart format
CPLane	Specifies the complex plane format

Query response

{RECT|POL|SMIT|ADM|CPL}<newline><^END>

Related commands

DISP:TRAC{1-3}:Y:SPAC command on page 371

Front Panel Equivalents

Meas/Format - **Meas/Format...** - Format

DISP:TRAC{1-3}:REF

Format

DISPlay[:WINDow]:TRACe{1-3}:REFerence[:STATe] {ON|OFF|1|0}

DISPlay[:WINDow]:TRACe{1-3}:REFerence[:STATe]?

Description

Selects whether to display the scale reference line for the linear Y-axis format.

Parameters

Sub-block	Description
TRACe{1-3}	Specifies the trace number (1 to 3)

	Description
ON or 1 (Default)	Displays the reference line.
OFF or 0	Does not display the reference line.

Query response

{1|0}<newline><^END>

Related commands

DISP:TRAC{1-3}:Y:RPOS command on page 370

DISP:TRAC{1-5}:Y:RLEV command on page 369

Front Panel Equivalents

Scale - **Scale...** - Reference Line [On/Off]

DISP:TRAC{1-5}:SEL

Format

DISPlay[:WINDow]:TRACe{1-5}:SELect

Description

Sets the specified trace to the active trace. (No query)

Parameters

Sub-block	Description
TRACe{1-5}	Specifies the trace number (1 to 5)

Front Panel Equivalents

Trace - **Scalar{1|2|3}|Complex{4|5}**

DISP:TRAC{1-5}:TEXT

Format

DISPlay[:WINDow]:TRACe{1-5}:TEXT[:STATe] {ON|OFF|1|0}

DISPlay[:WINDow]:TRACe{1-5}:TEXT[:STATe]?

Description

Switches between the graph display and list display on the specified trace.

Parameters

Sub-block	Description
TRACe{1-5}	Specifies the trace number (1 to 5)

	Description
ON or 1	Specifies the list display.
OFF or 0 (Default)	Specifies the graph display.

Query response

{1|0}<newline><^END>

Related commands

DISP:TRAC{1-5}:TEXT:PAGE command on page 359

Front Panel Equivalents

Display - **Display...** - List Values [On/Off]

DISP:TRAC{1-5}:TEXT:PAGE

Format

DISPlay[:WINDow]:TRACe{1-5}:TEXT:PAGE {UP|DOWN}

Description

Scrolls the page when the screen is the list display. This command is ignored when the screen is the graph display. (No query)

Parameters

Sub-block	Description
TRACe{1-5}	Specifies the trace number (1 to 5)

	Description
UP	Scrolls the screen display up.
DOWN	Scrolls the screen display down.

Related commands

DISP:TRAC{1-5}:TEXT command on page 359

Front Panel Equivalents

scroll the screen using the scroll bar

DISP:TRAC{1-5}:TITL

Format

DISPlay[:WINDow]:TRACe{1-5}:TITLe[:STATe] {ON|OFF|1|0}

DISPlay[:WINDow]:TRACe{1-5}:TITLe[:STATe]?

Description

Sets whether to display the trace title.

In addition, use the **DISP:TRAC{1-5}:TITL:DATA** command to set the string to be displayed in the trace title area.

Parameters

Sub-block	Description
TRACe{1-5}	Specifies the trace number (1 to 5)

	Description
ON or 1 (Default)	Displays the title.
OFF or 0	Does not display the title.

Query response

{1|0}<newline><^END>

Related commands

DISP:TRAC{1-5}:TITL:DATA command on page 361

Front Panel Equivalents

Display - **Display...** - More - Title - OK

DISP:TRAC{1-5}:TITL:DATA

Format

DISPlay[:WINDow]:TRACe{1-5}:TITLe:DATA <string>

DISPlay[:WINDow]:TRACe{1-5}:TITLe:DATA?

Description

Sets the string to be displayed in the trace title area.

In addition, use the **DISP:TRAC{1-5}:TITL** command to display the trace title.

Parameters

Sub-block	Description
TRACe{1-5}	Specifies the trace number (1 to 5)

	<string>
Description	Trace title
Default	Blank ("")

Query response

{string}<newline><^END>

Related Commands

DISP:TRAC{1-5}:TITL command on page 360

Front Panel Equivalents

Display - **Display...** - More - Title

DISP:TRAC{4-5}:X:RLEV

Format

DISPlay[:WINDow]:TRACe{4-5}:X[:SCALe]:RLEVel <numeric>

DISPlay[:WINDow]:TRACe{4-5}:X[:SCALe]:RLEVel?

Description

Sets the reference value (center value) of the X-axis in the complex plane format.

In addition, use the **DISP:TRAC{1-5}:Y:RLEV** command to set the reference value of the Y-axis.

Parameters

Sub-block	Description
TRACe{4-5}	Specifies the trace number (4 to 5)

	<numeric>
Description	Reference value of X-axis
Data type	Floating point
Range	Variable depending on the measurement parameter.
Default	0
Unit	Variable depending on the measurement parameter.

Query response

{numeric}<newline><^END>

Related commands

DISP:TRAC{1-5}:Y:RLEV command on page 369

Front Panel Equivalents

Scale - **Scale...** - Ref X

DISP:TRAC{1-5}:X:SPAC

Format

DISPlay[:WINDow]:TRACe{1-5}:X:SPACing {LINear|LOGarithmic|OBASe}

DISPlay[:WINDow]:TRACe{1-5}:X:SPACing?

Description

Selects whether to display the frequency span as the range from the minimum value to the maximum value or to display it divided by segment at the time of segment sweep.

Parameters

Sub-block	Description
TRACe{1-5}	Specifies the trace number (1 to 5)

	Description
LINear (Default)	Displays the frequency span as the single span from the minimum value to the maximum value on the linear scale.
LOGarithmic	Displays the frequency span as the single span from the minimum value to the maximum value on the log scale.
OBASe	Displays the frequency span divided in each segment.

Query response

{LIN|LOG|OBAS}<newline><^END>

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Display

DISP:TRAC{1-5}:Y:AUTO

Format DISPlay[:WINDow]:TRACe{1-5}:Y[:SCALe]:AUTO

Description Executes autoscale so that the trace fits the scale. (No query)

Parameters

Sub-block	Description
TRACe{1-5}	Specifies the trace number (1 to 5)

Related commands **DISP:TRAC:Y:AUTO:ALL** command on page 364

Front Panel Equivalents **Scale** - **Autoscale**

DISP:TRAC:Y:AUTO:ALL

Format DISPlay[:WINDow]:TRACe:Y[:SCALe]:AUTO:ALL

Description Executes autoscale so that all traces fit the scale. (No query)

Related commands **DISP:TRAC{1-5}:Y:AUTO** command on page 364

Front Panel Equivalents **Scale** - **Autoscale All**

DISP:TRAC{1-3}:Y:BOTT

Format

DISPlay[:WINDow]:TRACe{1-3}:Y[:SCALe]:BOTTom <numeric>

DISPlay[:WINDow]:TRACe{1-3}:Y[:SCALe]:BOTTom?

Description

Sets the minimum scale value in the Y-axis direction for the scalar trace.

In addition, use the **DISP:TRAC{1-3}:Y:TOP** command to set the maximum scale value.

Parameters

Sub-block	Description
TRACe{1-3}	Specifies the trace number (1 to 3)

	<numeric>
Description	Minimum scale value in the Y-axis direction
Data type	Floating point
Default	Variable depending on the measurement parameter. **In the Linear Y-Axis format:** -1 |Γ|/Γx/Γy -200 θγ/θz/θy 0 B/D/Cs/Cp/|εr|/εr'/εr''/tanδ (μ)/G/Ls/Lp/|μr|/μr'/μr''/Q/R/Rs/Rp/X/|Z|/|Y| **In the Log Y-Axis format:** 1E-9 Cs/Cp 1E-6 B/D/tanδ (ε)/tanδ (μ)/G/|Γ|/Γx/Γy/|Y| 1E-5 Ls/Lp 1E-4 θγ/θz/θy 1E-3 Q 1 |εr|/εr'/εr''/|μr|/μr'/μr''/R/Rs/Rp/|Z|/X
Unit	Variable depending on the measurement parameter.

Query response

{numeric}<newline><^END>

Related commands

DISP:TRAC{1-3}:Y:TOP command on page 372

Front Panel Equivalents

Scale - **Scale...** - Bottom

DISP:TRAC{1-5}:Y:FOR

Format

DISPlay[:WINDow]:TRACe{1-5}:Y[:SCALe]:FOR {DATA|MEMory|AND}

DISPlay[:WINDow]:TRACe{1-5}:Y[:SCALe]:FOR?

Description

Selects the trace to set the scale.

Parameters

Sub-block	Description
TRACe{1-5}	Specifies the trace number (1 to 5)

	Description
DATA	Specifies the data trace to set the scale.
MEMory*1	Specifies the memory trace to set the scale.
AND*1	Specifies both the data trace and memory trace to set the scale.

*1. Can be set when the memory trace is displayed with the **CALC{1-5}:MATH:FUNC** command.

Query response

{DATA|MEM|AND}<newline><^END>

Related commands

CALC{1-5}:MATH:FUNC command on page 340

Front Panel Equivalents

Scale - **Scale...** - Scale For

DISP:TRAC{1-5}:Y:FULL

Format

DISPlay[:WINDow]:TRACe{1-5}:Y[:SCALe]:FULL <numeric>

DISPlay[:WINDow]:TRACe{1-5}:Y[:SCALe]:FULL?

Description

Sets the following parameters for the display trace:

- Full-scale value in the linear Y-axis format
- Scale value in the polar format
- Full-scale value in the complex plane format

Parameters

Sub-block	Description
TRACe{1-5}	Specifies the trace number (1 to 5)

	<numeric>
Description	• Full-scale value in the linear Y-axis format*1 • Scale value in the polar format • Full-scale value in the complex plane format*1
Data type	Floating point
Range	Variable depending on the measurement parameter. **In the Linear Y-axis format:** 1E-3 Cs/Cp 1 B/D/tanδ (ε)/tanδ (μ)/G/|Y| 2 |Γ|/Γx/Γy 10 Ls/Lp 360 θγ/θz/θy 1E3 Q 1E6 |εr|/εr'/εr"/|μr|/μr'/μr"/R/Rs/Rp/|Z|/X **In the Polar format:** 1 Z/Y/Γ/εr/μr **In the Complex format:** 500 Z/Y/Γ/εr/μr
Unit	Variable depending on the measurement parameter.

*1.When one-tenths value of full-scale is set with the **DISP:TRAC{1-5}:Y:PDIV** command instead of setting full-scale value in the linear Y-axis or polar format, its 10-time value is set to the full-scale value.

Query response

{numeric}<newline><^END>

Related commands **DISP:TRAC{1-5}:Y:PDIV** command on page 368

Front Panel Equivalents **Scale** - **Scale...** - Full-scale|Scale

DISP:TRAC{1-5}:Y:PDIV

Format DISPlay[:WINDow]:TRACe{1-5}:Y[:SCALe]:PDIVision <numeric>

DISPlay[:WINDow]:TRACe{1-5}:Y[:SCALe]:PDIVision?

Description Sets the Y-axis direction scale by using a one-tenths value of full-scale. However, the setting value here does not always have a one-to-one correspondence to the scale value per division.

In addition, use the **DISP:TRAC{1-5}:Y:FULL** command to set the full-scale value.

Parameters

Sub-block	Description
CALCulate{1-5}	Specifies the trace number (1 to 5).

	<numeric>
Description	One-tenths value of full-scale
Data type	Floating point
Range	Variable depending on the measurement parameter. **In the Linear Y-axis format:** 1E-4 Cs/Cp 0.1 B/D/tanδ (ε)/tanδ (μ)/G/|Y| 0.2 |Γ|/Γx/Γy 1 Ls/Lp 36 θγ/θz/θy 1E2 Q 1E5 |εr|/εr'/εr"/|μr|/μr'/μr"/R/Rs/Rp/|Z|/X **In the Complex format:** 50 Z/Y/Γ/εr/μr
Default	Variable depending on the measurement parameter.

Query response {numeric}<newline><^END>

Related commands **DISP:TRAC{1-5}:Y:FULL** command on page 367

Front Panel Equivalents Unavailable.

DISP:TRAC{1-5}:Y:RLEV

Format

DISPlay[:WINDow]:TRACe{1-5}:Y[:SCALe]:RLEVel <numeric>

DISPlay[:WINDow]:TRACe{1-5}:Y[:SCALe]:RLEVel?

Description

Sets the following parameters for the display trace.

- Reference value in the linear Y-axis format
- Reference value of Y-axis in the complex plain format (center value)

Parameters

Sub-block	Description
TRACe{1-5}	Specifies the trace number (1 to 5)

	<numeric>
Description	• Reference value in the linear Y-axis format • Reference value of the Y-axis in the complex plane format (center value)
Data type	Floating point
Default	Variable depending on the measurement parameter. **In the Linear Y-axis format:** 5E-4 Cs/Cp 0.5 B/D/tanδ (ε)/tanδ (μ)/G/|Y| 0 |Γ|/Γx/Γy/θγ/θz/θy 5 Ls/Lp 500 Q 5E5 |εr|/εr'/εr"/|μr|/μr'/μr"/R/Rs/Rp/|Z|/X **In the Complex format:** 0 Z/Y/Γ/εr/μr
Unit	Variable depending on the measurement parameter

Query response

{numeric}<newline><^END>

Related commands

DISP:TRAC{1-3}:Y:RPOS command on page 370

Front Panel Equivalents

Scale - **Scale...** - Ref Val|Ref Y

DISP:TRAC{1-3}:Y:RPOS

Format

DISPlay[:WINDow]:TRACe{1-3}:Y[:SCALe]:RPOSition <numeric>

DISPlay[:WINDow]:TRACe{1-3}:Y[:SCALe]:RPOSition?

Description

Sets the following parameter for the display trace.

- Reference line position in the linear Y-axis format

Parameters

Sub-block	Description
TRACe{1-3}	Specifies the trace number (1 to 3)

	<numeric>
Description	Reference line position in the linear Y-axis format
Data type	Floating point
Range	0 to 100
Default	50
Resolution	0.01

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

DISP:TRAC{1-5}:Y:RLEV command on page 369

Front Panel Equivalents

Scale - **Scale...** - Ref Pos

DISP:TRAC{1-3}:Y:SPAC

Format

DISPlay[:WINDow]:TRACe{1-3}:Y:SPACing {LINer|LOGarithmic}

DISPlay[:WINDow]:TRACe{1-3}:Y:SPACing?

Description

Selects the Y-axis display format when the rectangle format is selected.

In addition, use the **DISP:TRAC{1-5}:GRAT:FORM** command to select the trace display format.

Parameters

Sub-block	Description
TRACe{1-3}	Specifies the trace number (1 to 3).

	Description
LINer (Default)	Specifies the linear Y-axis format
LOGarithmic	Specifies the logarithmic Y-axis format

Query response

{LIN|LOG}<newline><^END>

Related commands

DISP:TRAC{1-5}:GRAT:FORM on page 357

Front Panel Equivalents

Meas/Format - **Meas/Format...** - Format

DISP:TRAC{1-3}:Y:TOP

Format

DISPlay[:WINDow]:TRACe{1-3}:Y[:SCALe]:TOP <numeric>

DISPlay[:WINDow]:TRACe{1-3}:Y[:SCALe]:TOP?

Description

Sets the maximum scale value in the Y-axis direction for the scalar trace.

In addition, use the **DISP:TRAC{1-3}:Y:BOTT** command to set the minimum scale value.

Parameters

Sub-block	Description
TRACe{1-3}	Specifies the trace number (1 to 3).

	<numeric>
Description	Maximum scale value in the Y-axis direction
Data type	Floating point
Default	Variable depending on the measurement parameter. 1E-3 Cs/Cp 1 B/D/tanδ (ε)/tanδ (μ)/G/|Γ|/Γx/Γy/|Y| 10 Ls/Lp 200 θγ/θz/θy 1E3 Q 1E6 |εr|/εr'/εr"/|μr|/μr'/μr"/R/Rs/Rp/|Z|/X
Unit	Variable depending on the measurement parameter

Query response

{numeric}<newline><^END>

Related commands

DISP:TRAC{1-3}:Y:BOTT command on page 365

Front Panel Equivalents

Scale - **Scale...** - Top

FORM:BORD

Format

FORMat:BORDer {NORMal|SWAPped}

FORMat:BORDer?

Description

Selects the transfer order (byte order) of each byte of data (8 bytes) when binary transfer is selected for the data transfer format with the **FORM:DATA** command.

Parameters

	Description
NORMal (Default)	Specifies the byte order to start the transfer from the byte that contains MSB (Most Significant Bit).
SWAPped	Specifies the byte order to start the transfer from the byte that contains LSB (Least Significant Bit).

Query response

{NORM|SWAP}<newline><^END>

Related commands

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

FORM:DATA

Format

FORMat:DATA {ASCii[,0]|REAL[,32]|REAL,64}

FORMat:DATA?

Description

Sets the transfer format used for data transfer with the following GPIB commands:

- **DATA:CAD{1-8}?** command on page 345
- **DATA:SEGM{1-16}:CAD{1-8}?** command on page 350
- **DATA:CCO{1-6}** command on page 346
- **DATA:SEGM{1-16}:CCO{1-6}** command on page 351
- **DATA:CMD{1-2}?** command on page 347
- **DATA:SEGM{1-16}:CMD{1-2}?** command on page 352
- **DATA:CMP{1-3}** command on page 348
- **DATA:SEGM{1-16}:CMP{1-3}** command on page 353
- **DATA:RAW?** command on page 349
- **CALC{1-5}:DATA?** command on page 293
- **CALC:DATA:MON?** command on page 292
- **SENS:CORR1:CKIT:STAN1:LIST:B** command on page 424
- **SENS:CORR1:CKIT:STAN1:LIST:G** command on page 425
- **SENS:CORR1:CKIT:STAN2:LIST:R** command on page 427
- **SENS:CORR1:CKIT:STAN2:LIST:X** command on page 428
- **SENS:CORR1:CKIT:STAN3:LIST:R** command on page 431
- **SENS:CORR1:CKIT:STAN3:LIST:X** command on page 432
- **SENS:CORR2:CKIT:STAN1:LIST:B** command on page 443
- **SENS:CORR2:CKIT:STAN1:LIST:G** command on page 444
- **SENS:CORR2:CKIT:STAN2:LIST:R** command on page 446
- **SENS:CORR2:CKIT:STAN2:LIST:X** command on page 447
- **SWE:STIM{1-4}?** command on page 512

Parameters

	Description
ASCii (Default)	Specifies the ASCII transfer format.
REAL, 32	Specifies the IEEE 32-bit floating-point format.
REAL, 64	Specifies the IEEE 64-bit floating-point format.

Query response

{ASC,0|REAL,32|REAL,64}<newline><^END>

Front Panel Equivalents

Unavailable.

FREQ

Format

[SENSe:]FREQuency[:CW|:FIXed] <numeric>

[SENSe:]FREQuency[:CW|:FIXed]?

Description

Sets the CW frequency for the oscillator level sweep, dc bias voltage sweep, or dc bias current sweep.

Parameters

Either CW or FIXed can be written when describing the sub-block of the command, although [:CW|:FIXes] in the sub-block part can be omitted.

	<numeric>
Description	CW frequency
Data type	Floating point
Range	1E6 to 3E9
Default	1E6
Resolution	1E-3
Unit	Hz

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Front Panel Equivalents

Stimulus - **Source...** - CW Freq: Hz

FREQ:CENT

Format

[SENSe:]FREQuency:CENTer <numeric>

[SENSe:]FREQuency:CENTer?

Description

Sets the center value in the frequency sweep range (linear/log sweep).

In addition, use the **FREQ:SPAN** command to set the span value in the sweep range.

Parameters

	<numeric>
Description	Center value in the sweep range
Data type	Floating point
Range	1E6 to 3E9
Default	1.5005E9
Resolution	1E-3
Unit	Hz

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

FREQ:SPAN command on page 377

Front Panel Equivalents

Stimulus - **Start/Stop...** - Center: Hz

FREQ:SPAN

Format

[SENSe:]FREQuency:SPAN <numeric>

[SENSe:]FREQuency:SPAN?

Description

Sets the span value in the frequency sweep range (linear/log sweep).

In addition, use the **FREQ:CENT** command to set the center value in the sweep range.

Parameters

	<numeric>
Description	Span value in the sweep range
Data type	Floating point
Range	1E6 to 2999E6
Default	2.999E9
Resolution	1E-3
Unit	Hz

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

FREQ:CENT command on page 376

Front Panel Equivalents

Stimulus - **Start/Stop...** - Span: Hz

FREQ:SPAN:FULL

Format

[SENSe:]FREQuency:SPAN:FULL

Description

Sets the sweep range in full span (1 M to 3 GHz) for the frequency sweep (linear/log sweep). (No query)

Front Panel Equivalents

Unavailable.

FREQ:STAR

Format

[SENSe:]FREQuency:STARt <numeric>

[SENSe:]FREQuency:STARt?

Description

Sets the start value in the frequency sweep range (linear/log sweep).

In addition, use the **FREQ:STOP** command to set the stop value in the sweep range.

Parameters

	<numeric>
Description	Start value in the sweep range
Data type	Floating point
Range	1E6 to 3E9
Default	1E6
Resolution	1E-3
Unit	Hz

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

FREQ:STOP command on page 379

Front Panel Equivalents

Stimulus - **Start/Stop...** - Start: Hz

FREQ:STOP

Format

[SENSe:]FREQuency:STOP <numeric>

[SENSe:]FREQuency:STOP?

Description

Sets the stop value in the frequency sweep range (linear/log sweep).

In addition, use the **FREQ:STAR** command to set the start value in the sweep range.

Parameters

	<numeric>
Description	Stop value in the sweep range
Data type	Floating point
Range	1E6 to 3E9
Default	3E9
Resolution	1E-3
Unit	Hz

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

FREQ:STAR command on page 378

Front Panel Equivalents

Stimulus - **Start/Stop...** - Stop: Hz

HCOP

Format: HCOPy[:IMMediate]

Description: Outputs the print content selected with the **HCOP:CONT** command to a printer connected to the E4991A. (No query)

Related commands: **HCOP:CONT** command on page 380

Front Panel Equivalents: See *Operation Manual*

HCOP:ABOR

Format: HCOPy:ABORt

Description: Aborts the print outputs. (No query)

Front Panel Equivalents: See *Operation Manual*

HCOP:CONT

Format: HCOPy:CONTent {SCReen|SETup|LIST}

HCOPy:CONTent?

Description: Selects the print content.

Parameters

	Description
SCReen (Default)	Specifies the active graph for the graph display of the measurement result.
SETup	Specifies the text output of major setting parameters.
LIST	Specifies the list output of measurement result.

Query response: {SCR|SET|LIST}<newline><^END>

Related commands: **HCOP:IMAG** command on page 381

Front Panel Equivalents: **Display** - **Print** - **Graph(Color)**|**Graph(Mono)**|**List Values**|**Operating Parameters**

HCOP:IMAG

Format

HCOPy:IMAGe {INVert|MONochrome}

HCOPy:IMAGe?

Description

Selects the print color for the printer output.

Parameters

	Description
INVert*1 (Default)	Specifies the color image (but background color is always white).
MONochrome	Specifies the monochrome image (inverted screen display color).

*1. Can be selected when the print content is chosen for the measurement result graph display using the **HCOP:CONT** command.

Query response

{INV|MON}<newline><^END>

Related commands

HCOP:CONT command on page 380

Front Panel Equivalents

Display - **Print** - **Graph(Color)**|**Graph(Mono)**

INIT

Format

INITiate[:IMMediate]

Description

The trigger system is started from the idle state when this command is executed. The idle state is resumed when the trigger cycle is performed once. Executing this command results in an error when the trigger system is not in the idle state or the trigger system is set to be started continuously (continuous start is specified with the **INIT:CONT** command). (No query)

Related commands

INIT:CONT command on page 382

Front Panel Equivalents

Trigger - **Single**

INIT:CONT

Format

INITiate:CONTinuous {ON|OFF|1|0}

INITiate:CONTinuous?

Description

Sets whether to start the trigger system continuously.

In addition, this is set to off when executing the ***RST** command.

Parameters

	Description
ON or 1 (Default)	Instructs the instrument to continuously activate the trigger system.
OFF or 0	Instructs the instrument NOT to continuously activate the trigger system.

Query response

{1|0}<newline><^END>

Related commands

***RST** command on page 282

Front Panel Equivalents

Trigger - **Continuous**|**Hold**

MMEM:CAT?

Format

MMEMory:CATalog?

Description

Returns the list of files present in the current folder. (Query only)

Query response

{string}<newline><^END>

Files are separated by commas (,) when plural files are present. Empty quotation marks (“”) are returned when no file is present in the folder.

Front Panel Equivalents

Save/Recall - **Save State...**|**Save Data...**|**Save Graphics...**|**Recall State...**|**Recall Data...**

MMEM:CDIR

Format

MMEMory:CDIRectory <string>

MMEMory:CDIRectory?

Description

Changes the current folder when saving or recalling the file.

Parameters

	<String>
Description	Specifies the full path of the folder hierarchy by using the drive name and the folder name.
Default	"D:\Documents"

Query response

{string}<newline><^END>

Front Panel Equivalents

Save/Recall - **Save State...**|**Save Data...**|**Save Graphics...**|**Recall State...**|**Recall Data...**

MMEM:COPY

Format

MMEMory:COPY <string 1>,<string 2>

Description

Copies the file. (No query)

Parameters

	<string 1>	<string 2>
Description	Source file name to copy (with extension)	Destination file name to copy (with extension)
Range	Maximum 255 characters (including the extension)	Maximum 255 characters (including the extension)

Source and destination file names to copy have to be specified with an extension attached.

Front Panel Equivalents

Save/Recall - **Save State...**|**Save Data...**|**Save Graphics...**|**Recall State...**|**Recall Data...** - Copy to FDD

MMEM:DEL

Format

MMEMory:DELete <string>

Description

Deletes the file saved in the E4991A. (No query)

Parameters

	<string>
Description	File name to be deleted (with extension)
Range	Maximum 255 characters (including the extension)

File names must be specified with an extension attached.

Front Panel Equivalents

Save/Recall - **Save State...**|**Save Data...**|**Save Graphics...**|**Recall State...**|**Recall Data...** - Delete

MMEM:LOAD

Format MMEMory:LOAD[:STATe] <string>

Description Recalls the state file of the E4991A. (No query)

Parameters

	<string>
Description	File name to be recalled (no extension needs to be attached to the file name).
Range	Maximum 255 characters

Front Panel Equivalents **Save/Recall** - **Recall State...** - OK

MMEM:LOAD:MACR

Format MMEMory:LOAD:MACRo <string>

Description Load the macro. (no query)

Parameters

	<String>
Description	File name to be loaded (no extension needs to be attached to the file name).
Range	Maximum 255 characters

Related commands **MMEM:STOR:MACR** command on page 390

Front Panel Equivalents **Utility** - **Load Program...** - OK

MMEM:LOAD:TRAC

Format

MMEMory:LOAD:TRACe <string>

Description

Recalls the internal data array of the E4991A saved with the **MMEM:STOR:TRAC** command. (No query)

Parameters

	<string>
Description	File name to be recalled (no extension needs to be attached to the file name).
Range	Maximum 255 characters

Related commands

MMEM:STOR:TRAC command on page 391

Front Panel Equivalents

Save/Recall - **Recall Data...** - OK

MMEM:MDIR

Format

MMEMory:MDIRectory <string>

Description

Creates a new folder. (No query)

Parameters

	<string>
Description	New folder name to create
Range	Maximum 255 characters

Front Panel Equivalents

Save/Recall - **Save State...**|**Save Data...**|**Save Graphics...**|**Recall State...**|**Recall Data...** - New Folder

MMEM:MOVE

Format

MMEMory:MOVE <string 1>,<string 2>

Description

Changes the specified file to another name. (No query)

Parameters

	<string 1>	**<string 2>**
Description	Original file name (with extension)	Changed file name (with extension)
Range	Maximum 255 characters (including the extension)	Maximum 255 characters (including the extension)

The file name has to be specified with an extension attached.

Front Panel Equivalents

Unavailable.

MMEM:RDIR

Format

MMEMory:RDIRectory <string>

Description

Deletes the folder. (No query)

Parameters

	<string>
Description	Folder name
Range	Up to 255 strings (including extension)

Front Panel Equivalents

Save/Recall - **Save State...**|**Save Data...**|**Save Graphics...**|**Recall State...**|**Recall Data...** - Delete

MMEM:STOR

Format

MMEMory:STORe[:STATe] <string>

Description

Saves the state file of E4991A.(No query)

The contents saved in the state file are as follows.

- Measurement conditions (Setting parameter)
- Data array/Data trace array
- Memory array/Memory trace array
- Calibration data array
- Fixture compensation data array
- Standard value of calibration kit defined by user
- Standard value of the fixture compensation kit defined by user

In addition, recall the saved state file with the **MMEM:LOAD** command.

Parameters

	<string>
Description	Saved file name (no need to attach extension to the file name)
Range	Up to 255 strings

Related commands

MMEM:LOAD command on page 385

Front Panel Equivalents

Save/Recall - **Save State...** - OK

MMEM:STOR:CITI{1-3}

Format MMEMory:STORe:CITI{1-3} <string>

Description Saves the measurement data of the E4991A in the CITI file format. (No query)

Parameters

Sub block	Description
CITI1	Specifies 1-port model.
CITI2	Specifies 2-port Series model.
CITI3	Specifies 2-port Shunt model.

	<string>
Description	Saved file name (no need to attach extension to the file name)
Range	Up to 255 strings

Front Panel Equivalents **Save/Recall** - **Save Data...** - CITIfile - OK

MMEM:STOR:GRAP

Format MMEMory:STORe:GRAPh[:JPG] <string>

Description Saves graph display of the screen in the JPEG format. (No query)

Parameters

	<string>
Description	Saved file name (no need to attach extension to the file name)
Range	Up to 255 strings

Related commands **MMEM:STOR:GRAP:BMP** command on page 390

Front Panel Equivalents **Save/Recall** - **Save Graphics...** - Jpeg - OK

MMEM:STOR:GRAP:BMP

Format MMEMory:STORe:GRAPh:BMP <string>

Description Saves graph display of the screen in the Windows Bitmap format. (No query)

Parameters

	<string>
Description	Saved file name (no need to attach extension to the file name)
Range	Up to 255 strings

Related commands **MMEM:STOR:GRAP** command on page 389

Front Panel Equivalents **Save/Recall** - **Save Graphics...** - BMP - OK

MMEM:STOR:MACR

Format MMEMory:STORe:MACRo <string>

Description Saves macro. (No Query)

Parameters

	<String>
Description	Saved file name (no need to attach extension to the file name)
Range	Up to 255 strings

Related commands **MMEM:LOAD:MACR** command on page 385

Front Panel Equivalents **Utility** - **Save Program...** - OK

MMEM:STOR:TRAC

Format

MMEMory:STORe:TRAC[:BINary] <string>

Description

Saves the specified internal data array in binary form. (No query)

In addition, select the saving data array with the **MMEM:STOR:TRAC:SEL{1-4}** command.

Parameters

	<string>
Description	Saved file name (no need to attach extension to the file name)
Range	Up to 255 strings

Related commands

MMEM:STOR:TRAC:ASC command on page 391

MMEM:STOR:TRAC:SEL{1-4} command on page 392

Front Panel Equivalents

Save/Recall - **Save Data...** - Binary - OK

MMEM:STOR:TRAC:ASC

Format

MMEMory:STORe:TRACe:ASCii <string>

Description

Saves the specified internal array in ASCII format. (No query)

In addition, in order to select the saving data array, use the **MMEM:STOR:TRAC:SEL{1-4}** command.

Parameters

	<string>
Description	Saved file name (no need to attach extension to the file name)
Range	Up to 255 strings

Related commands

MMEM:STOR:TRAC command on page 391

MMEM:STOR:TRAC:SEL{1-4} command on page 392

Front Panel Equivalents

Save/Recall - **Save Data...** - ASCII - OK

MMEM:STOR:TRAC:SEL{1-4}

Format

MMEMory:STORe:TRACe:SELect{1-4} {ON|OFF|1|0}

MMEMory:STORe:TRACe:SELect{1-4}?

Description

When saving the internal data array with the **MMEM:STOR:TRAC** command or **MMEM:STOR:TRAC:ASC** command, sets whether to save the data array.

Parameters

Sub-block	Description
SELect1	Specifies data array.
SELect2	Specifies data trace array.
SELect3	Specifies memory array.
SELect4	Specifies memory trace array.

	Description
ON or 1 (Default*1)	Specifies the setting to save the internal data array.
OFF or 0 (Default*2)	Specifies the setting NOT to save the internal data array.

*1.data trace array/memory trace array
*2.data array/memory array

Query response

{1|0}<newline><^END>

Related commands

MMEM:STOR:TRAC command on page 391

MMEM:STOR:TRAC:ASC command on page 391

Front Panel Equivalents

Save/Recall - **Save Data...** - Data|Memory|Trace Data|Trace Memory

MODE

Format

[SENSe:]MODE {IMPedance|PERMITtivity|PERMEAbility}

[SENSe:]MODE?

Description

Selects the measurement mode of the E4991A.

Parameters

	Description
IMPedance (Default)	Specifies the impedance measurement mode.
PERMITtivity*1	Specifies the dielectric measurement mode.
PERMEAbility*1	Specifies the magnetic measurement mode.

*1. This can be selected if Option 002 (materials measurement software) is installed.

Query response

{IMP|PERMIT|PERMEA}<newline><^END>

Front Panel Equivalents

Utility - **Material Option...** - Material Type

PROG:CAT?

Format
PROGram:CATalog?

Description
Returns a list of macros. (Query only).

Query response
{String}<newline><^END>

Format of strings is <module name>.<procedure name>.

When multiple macros exist, they are separated by commas (,). Also, when no macro exists, empty quotation marks (“”) are returned.

Front Panel Equivalents
Utility - **VBA Macros...**

PROG:NAME

Format
PROGram[:SELected]:NAME <string>

PROGram[:SELected]:NAME?

Description
Defines the macro name. The **PROG:STAT** and **PROG:WAIT** commands are used in the macro name defined here.

Parameters

	<String>
Description	Macro name*1

*1. Macro name is defined by <module name>.<procedure name>, or <procedure name>.

Query response
{String}<newline><^END>

Format of strings is <module name>.<procedure name>.

Related commands
PROG:STAT command on page 395

PROG:WAIT command on page 395

Front Panel Equivalents
Unavailable.

PROG:STAT

Format

PROGram[:SELected]:STATe {RUN|STOP}

PROGram[:SELected]:STATe?

Description

Sets the macro status.

Parameters

	Description
RUN	Executes macro.
STOP (Default)	Stops macro.

Query response

{RUN|STOP}<newline><^END>

Related commands

PROG:NAME command on page 394

Front Panel Equivalents

Utility - **Visual Basic Editor...** - **Run Macro**|**Break**

PROG:WAIT

Format

PROGram[:SELected]:WAIT

PROGram[:SELected]:WAIT?

Description

Waits until the macro changes to the stop condition from the execution condition.

Query response

{Numeric}<newline><^END>

When the macro changes to the stop condition, an integer value of 1 is returned.

Related commands

PROG:NAME command on page 394

Front Panel Equivalents

Unavailable.

SEGM{1-16}:AVER:COUN

Format

[SENSe:]SEGMent{1-16}:AVERage:COUNt <numeric>

[SENSe:]SEGMent{1-16}:AVERage:COUNt?

Description

When creating the segment sweep table, sets the point averaging factor.

Parameters

Sub-block	Description
SEGMent {1-16}	Specifies the segment number (1 to 16).

	<numeric>
Description	Point averaging factor
Data type	Integer
Range	1 to 100
Default	1

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - Point Average

SEGM:COUN

Format

[SENSe:]SEGMent:COUNt <numeric>

[SENSe:]SEGMent:COUNt?

Description

After clearing the segment parameters within the segment sweep table, creates the specified number of new segments. In addition, all of the default segment parameters are inputted within the segment table.

Parameters

	<numeric>
Description	Total number of segments
Data type	Integer
Range	0[*1] to 16
Default	0

*1. When segment sweep is selected, it is not possible to set the number of segments to 0.

Query response

{numeric}<newline><^END>

Front Panel Equivalents

Unavailable.

SEGM{1-16}:CURR

Format

[SENSe:]SEGMent{1-16}:CURRent[:LEVel] <numeric>

[SENSe:]SEGMent{1-16}:CURRent[:LEVel]?

Description

When creating the segment sweep table, sets the oscillator current level.

Parameters

Sub-block	Description
SEGMent {1-16}	Specifies the segment number (1 to 16).

	<numeric>
Description	Oscillator current level
Data type	Floating point
Range	0.1E-3 to 10E-3
Default	2E-3
Resolution	0.01E-3
Unit	A (ampere)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SEGM:CURR:STAT command on page 402

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - More - Osc Level: A

SEGM:CURR:OFFS:STAT

Format

[SENSe:]SEGMent:CURRent:OFFSet:STATe {ON|OFF|1|0}

[SENSe:]SEGMent:CURRent:OFFSet:STATe?

Description

When creating the segment sweep table, selects the voltage mode to set the dc bias level. This command can be used when Option 001 (dc bias function) is installed.

In addition, use the **SEGM{1-16}:CURR:OFFS** command to select the current mode to set the dc bias level.

Parameters

	Description
ON or 1 (Default)	Specifies the current mode.
OFF or 0	Specifies the voltage mode.

Query response

{1|0}<newline><^END>

Related commands

SEGM{1-16}:CURR:OFFS command on page 401

SEGM{1-16}:VOLT:LIM command on page 415

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - More - Bias Source

SEGM{1-16}:CURR:LIM

Format

[SENSe:]SEGMent{1-16}:CURRent:LIMit <numeric>

[SENSe:]SEGMent{1-16}:CURRent:LIMit?

Description

When creating the segment sweep table, sets the dc bias current limit maximum value. This command is available when Option 001 (dc bias function) is installed.

Parameters

Sub-block	Description
SEGMent {1-16}	Specifies the segment number (1 to 16).

	<numeric>
Description	dc bias current limit maximum value
Data type	Floating point
Range	2E-3 to 50E-3
Default	2E-3
Resolution	0.01E-3
Unit	A (ampere)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SEGM:VOLT:OFFS:STAT command on page 417

SEGM{1-16}:VOLT:OFFS command on page 416

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - More - Bias Limit [A]

SEGM{1-16}:CURR:OFFS

Format

[SENSe:]SEGMent{1-16}:CURRent:OFFSet <numeric>

[SENSe:]SEGMent{1-16}:CURRent:OFFSet?

Description

When creating the segment sweep table, sets the dc bias current level. This command is available when Option 001 (dc bias function) is installed.

Parameters

Sub-block	Description
SEGMent {1-16}	Specifies the segment number (1 to 16).

	<numeric>
Description	dc bias current level
Data type	Floating point
Range	-50E-3 to -100E-6, 100E-6 to 50E-3
Default	100E-6
Resolution	10E-6
Unit	A (ampere)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SEGM:CURR:OFFS:STAT command on page 399

SEGM{1-16}:VOLT:LIM command on page 415

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - More - Bias Level [A]

SEGM:CURR:STAT

Format

[SENSe:]SEGMent:CURRent:STATe {ON|OFF|1|0}

[SENSe:]SEGMent:CURRent:STATe?

Description

When creating the segment sweep table, selects the current mode to set the oscillator level.

In addition, use the **SEGM{1-16}:CURR** command to set the oscillator current level.

Parameters

	Description
ON or 1	Specifies the current mode.
OFF or 0 (Default)	Specifies the mode other than the current mode.*1

*1. When specifying a mode other than the current mode, specify either the power mode or the voltage mode with the **SEGM:POW:STAT** command or **SEGM:VOLT:STAT** command.

Query response

{1|0}<newline><^END>

Related commands

SEGM{1-16}:CURR command on page 398

SEGM:POW:STAT command on page 412

SEGM:VOLT:STAT command on page 418

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - More - Osc Unit

SEGM{1-16}:DATA

Format

[SENSe:]SEGMent{1-16}:DATA <numeric 1>,<numeric 2>,<numeric 3>,<numeric 4>,<numeric 5>,<numeric 6>,<numeric 7>

Description

When creating/editing the segment sweep table, simultaneously sets the parameter values of all segments. Before executing this GPIB command, you need to set the oscillator level to be read as current, dBm, or voltage by using the **SEGM:CURR:STAT** command, **SEGM:POW:STAT** command, or **SEGM:VOLT:STAT** command, respectively. When applying dc bias, you need to set either current or voltage by using the **SEGM:CURR:OFFS:STAT** command or **SEGM:VOLT:OFFS:STAT** command, respectively.

Parameters

Sub-block	Description
SEGMent {1-16}	Specifies the segment number (1 to 16).

	<numeric 1>	<numeric 2>	<numeric 3>	<numeric 4>
Description	Start frequency	Stop frequency	Number of points	Point averaging factor
Data type	Floating point		Integer	
Range	1E6 to 3E9	1E6 to 3E9	2 to 801*1	1 to 100
Default	1E6	3E9	2	1
Unit	Hz		None	

*1. The number of points cannot be set beyond 801 points, which is the sum of the points in all segments.

	<numeric 5>	<numeric 6>	<numeric 7>
Description	Oscillator level	dc bias current/voltage level	dc bias voltage/current limit maximum value
Data type	Floating point		
Range	voltage: 5E-3 to 502E-3 current: 0.1E-3 to 10E-3 power: -40 to 1	voltage: -40 to 40 current: -50E-3 to -100E-6, 100E-6 to 50E-3	current: 2E-3 to 50E-3 voltage: 1 to 40

	<numeric 5>	<numeric 6>	<numeric 7>
Default	voltage: 100E-3 current: 2E-3 power: -13.01	voltage: 0 current: 100E-6	current: 2E-3 voltage: 1
Unit	V/A/dBm	V/A	A/V

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

NOTE It is necessary to set the parameters of numeric 6 and numeric 7 when Option 001 (dc bias function) is not installed or dc bias is not applied to the DUT. In this case, set default values such as 100uA and 1V to the parameters of numeric 6 and numeric 7, respectively.

Query response {numeric 1},{numeric 2},..,{numeric 7}<newline><^END>

Related commands
SEGM:CURR:STAT command on page 402
SEGM:POW:STAT command on page 412
SEGM:VOLT:STAT command on page 418
SEGM:CURR:OFFS:STAT command on page 399
SEGM:VOLT:OFFS:STAT command on page 417

Front Panel Equivalents Unavailable.

SEGM:DATA:ALL

Format

[SENSe:]SEGMent:DATA:ALL <numeric 1>,<numeric 2>,<numeric 3>,<numeric 4>,<numeric 5>,<numeric 6>,<numeric 7>

Description

When creating the segment sweep table, sets the same content parameter values in all of the segments. Before executing this GPIB command, you need to set the oscillator level to be read as current, dBm, or voltage by using the **SEGM:CURR:STAT** command, **SEGM:POW:STAT** command, or **SEGM:VOLT:STAT** command, respectively. When applying dc bias, you need to set either current or voltage by using the **SEGM:CURR:OFFS:STAT** command or **SEGM:VOLT:OFFS:STAT** command, respectively. (No query)

Parameters

	<numeric 1>	**<numeric 2>**	**<numeric 3>**	**<numeric 4>**
Description	Start frequency	Stop frequency	Number of points	Point averaging factor
Data type	Floating point		Integer	
Range	1E6 to 3E9	1E6 to 3E9	2 to 801*1	1 to 100
Default	1E6	3E9	2	1
Unit	Hz		None	

*1. The number of points cannot be set beyond 801 points, which is the sum of the points in all segments.

	<numeric 5>	**<numeric 6>**	**<numeric 7>**
Description	Oscillator level	dc bias current/voltage level	dc bias voltage/current limit maximum value
Data type	Floating point		
Range	voltage: 5E-3 to 502E-3 current: 0.1E-3 to 10E-3 power: -40 to 1	voltage: -40 to 40 current: -50E-3 to -100E-6, 100E-6 to 50E-3	current: 2E-3 to 50E-3 voltage: 1 to 40

	<numeric 5>	<numeric 6>	<numeric 7>
Default	voltage: 100E-3 current: 2E-3 power: -13.01	voltage: 0 current: 100E-6	current: 2E-3 voltage: 1
Unit	V/A/dBm	V/A	A/V

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

NOTE It is necessary to set the parameters of numeric 6 and numeric 7 when Option 001 (dc bias function) is not installed or dc bias is not applied to the DUT. In this case, set default values such as 100uA and 1V to the parameters of numeric 6 and numeric 7, respectively.

Related commands

SEGM:CURR:STAT command on page 402

SEGM:POW:STAT command on page 412

SEGM:VOLT:STAT command on page 418

SEGM:CURR:OFFS:STAT command on page 399

SEGM:VOLT:OFFS:STAT command on page 417

Front Panel Equivalents

Unavailable.

SEGM:DEL:ALL

Format

[SENSe:]SEGMent:DELete:ALL

Description

Deletes all segments in the segment sweep table. In addition, this GPIB commnad is unavailable when the sweep parameter is set to segment sweep. (No query)

Front Panel Equivalents

Unavailable.

SEGM{1-16}:FREQ:CENT

Format

[SENSe:]SEGMent{1-16}:FREQuency:CENTer <numeric>

[SENSe:]SEGMent{1-16}:FREQuency:CENTer?

Description

When creating the segment sweep table, sets the center value in the frequency sweep range.

In addition, use the **SEGM{1-16}:FREQ:SPAN** command when setting the span value in the sweep range.

Parameters

Sub-block	Description
SEGMent {1-16}	Specifies the segment number (1 to 16).

	<numeric>
Description	Center value in the sweep range
Data type	Floating point
Range	1E6 to 3E9
Default	1.5005E9
Resolution	1E-3
Unit	Hz

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SEGM{1-16}:FREQ:SPAN command on page 408

Front Panel Equivalents

Unavailable.

SEGM{1-16}:FREQ:SPAN

Format

[SENSe:]SEGMent{1-16}:FREQuency:SPAN <numeric>

[SENSe:]SEGMent{1-16}:FREQuency:SPAN?

Description

When creating the segment sweep table, sets the span value in the frequency sweep range.

In addition, use the **SEGM{1-16}:FREQ:CENT** command when setting the center value in the sweep range.

Parameters

Sub-block	Description
SEGMent {1-16}	Specifies the segment number (1 to 16).

	<numeric>
Description	Span value in the sweep range
Data type	Floating point
Range	0 to 2999E6
Default	2.999E9
Resolution	1E-3
Unit	Hz

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SEGM{1-16}:FREQ:CENT command on page 407

Front Panel Equivalents

Unavailable.

SEGM{1-16}:FREQ:STAR

Format

[SENSe:]SEGMent{1-16}:FREQuency:STARt <numeric>

[SENSe:]SEGMent{1-16}:FREQuency:STARt?

Description

When creating the segment sweep table, sets the start value in the frequency sweep range.

In addition, use the **SEGM{1-16}:FREQ:STOP** command when setting the stop value in the sweep range.

Parameters

Sub-block	Description
SEGMent {1-16}	Specifies the segment number (1 to 16).

	<numeric>
Description	Start value in the sweep range
Data type	Floating point
Range	1E6 to 3E9
Default	1E6
Resolution	1E-3
Unit	Hz

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SEGM{1-16}:FREQ:STOP command on page 410

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - Start

SEGM{1-16}:FREQ:STOP

Format

[SENSe:]SEGMent{1-16}:FREQuency:STARt <numeric>

[SENSe:]SEGMent{1-16}:FREQuency:STARt?

Description

When creating the segment sweep table, sets the stop value in the frequency sweep range.

In addition, use the **SEGM{1-16}:FREQ:STAR** command when setting the start value in the sweep range.

Parameters

Sub-block	Description
SEGMent {1-16}	Specifies the segment number (1 to 16).

	<numeric>
Description	Stop value in the sweep range
Data type	Floating point
Range	1E6 to 3E9
Default	3E9
Resolution	1E-3
Unit	Hz

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SEGM{1-16}:FREQ:STAR command on page 409

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - Stop

SEGM{1-16}:POW

Format

[SENSe:]SEGMent{1-16}:POWer[:LEVel] <numeric>

[SENSe:]SEGMent{1-16}:POWer[:LEVel]?

Description

When creating the segment sweep table, sets the oscillator power level.

Parameters

Sub-block	Description
SEGMent {1-16}	Specifies the segment number (1 to 16).

	<numeric>
Description	Oscillator power level
Data type	Floating point
Range	-40 to 1
Default	-13.01
Unit	dBm

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SEGM:POW:STAT command on page 412

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - More - Osc level: dBm

SEGM:POW:STAT

Format

[SENSe:]SEGMent:POWer:STATe {ON|OFF|1|0}

[SENSe:]SEGMent:POWer:STATe?

Description

When creating the segment sweep table, selects the power mode to set the oscillator level.

In addition, use the **SEGM{1-16}:POW** command to set the oscillator power level.

Parameters

	Description
ON or 1	Specifies the power (dBm) mode.
OFF or 0 (Default)	Specifies a mode other than power mode.*1

*1. When specifying a mode other than the power mode, specify either current mode or voltage mode with the **SEGM:CURR:STAT** command or the **SEGM:VOLT:STAT** command, respectively.

Query response

{1|0}<newline><^END>

Related commands

SEGM{1-16}:POW command on page 411

SEGM:CURR:STAT command on page 402

SEGM:VOLT:STAT command on page 418

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - More - Osc Unit

SEGM{1-16}:SWE:POIN

Format

[SENSe:]SEGMent{1-16}:SWEep:POINts <numeric>

[SENSe:]SEGMent{1-16}:SWEep:POINts?

Description

When creating the segment sweep table, sets the number of points measured at each segment.

Parameters

Sub-block	Description
SEGMent {1-16}	Specifies the segment number (1 to 16).

	<numeric>
Description	Number of measurement points
Data type	Integer
Range	2 to 801*1
Default	2

*1. The number of points cannot be set beyond 801 points, which is the sum of the points in all segments.

Query response

{numeric}<newline><^END>

Related commands

SWE:POIN command on page 511

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - Number Of Points

SEGM{1-16}:VOLT

Format

[SENSe:]SEGMent{1-16}:VOLTage[:LEVel] <numeric>

[SENSe:]SEGMent{1-16}:VOLTage[:LEVel]?

Description

When creating the segment sweep table, sets the oscillator voltage level.

Parameters

Sub-block	Description
SEGMent {1-16}	Specifies the segment number (1 to 16).

	<numeric>
Description	Oscillator voltage level
Data type	Floating point
Range	5E-3 to 502E-3
Default	100E-3
resolution	1E-3
Unit	V (volt)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SEGM:VOLT:STAT command on page 418

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - More - Osc Level: V

SEGM{1-16}:VOLT:LIM

Format

[SENSe:]SEGMent{1-16}:VOLTage:LIMit <numeric>

[SENSe:]SEGMent{1-16}:VOLTage:LIMit?

Description

When creating the segment sweep table, sets the dc bias voltage limit maximum value. This command is available when Option 001 (dc bias function) is installed.

Parameters

Sub-block	Description
SEGMent {1-16}	Specifies the segment number (1 to 16).

	<numeric>
Description	dc bias voltage limit maximum value
Data type	Floating point
Range	1 to 40
Default	1
Resolution	1E-3
Unit	V (volt)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SEGM:CURR:OFFS:STAT command on page 399

SEGM{1-16}:CURR:OFFS command on page 401

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - More - Bias Limit [V]

SEGM{1-16}:VOLT:OFFS

Format

[SENSe:]SEGMent{1-16}:VOLTage:OFFSet <numeric>

[SENSe:]SEGMent{1-16}:VOLTage:OFFSet?

Description

When creating the segment sweep table, sets the dc bias voltage level. This command is available when Option 001 (dc bias function) is installed.

Parameters

Sub-block	Description
SEGMent {1-16}	Specifies the segment number (1 to 16).

	<numeric>
Description	dc bias voltage level
Data type	Floating point
Range	-40 to 40
Default	0
Resolution	1E-3
Unit	V (volt)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SEGM:VOLT:OFFS:STAT command on page 417

SEGM{1-16}:CURR:LIM command on page 400

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - More - Bias Level [V]

SEGM:VOLT:OFFS:STAT

Format

[SENSe:]SEGMent:VOLTage:OFFSet:STATe {ON|OFF|1|0}

[SENSe:]SEGMent:VOLTage:OFFSet:STATe?

Description

When creating the segment sweep table, selects the voltage mode to set the dc bias level. This command can be used when Option 001 (dc bias function) is installed.

In addition, use the **SEGM{1-16}:VOLT:OFFS** command to select the current mode to set the dc bias voltage level.

Parameters

	Description
ON or 1	Specifies the voltage mode.
OFF or 0 (Default)	Specifies the current mode.

Query response

{1|0}<newline><^END>

Related commands

SEGM{1-16}:VOLT:OFFS command on page 416

SEGM{1-16}:CURR:LIM command on page 400

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - More - Bias Source

SEGM:VOLT:STAT

Format

[SENSe:]SEGMent:VOLTage:STATe {ON|OFF|1|0}

[SENSe:]SEGMent:VOLTage:STATe?

Description

When creating the segment sweep table, selects the voltage mode to set the oscillator level.

In addition, use the **SEGM{1-16}:VOLT** command to set the oscillator voltage level.

Parameters

	Description
ON or 1 (Default)	Specifies the voltage mode.
OFF or 0	Specifies a mode other than the voltage mode.*1

*1. When specifying a mode other than the voltage mode, specify either the current mode or power mode with the **SEGM:CURR:STAT** command or the **SEGM:POW:STAT** command, respectively.

Query response

{1|0}<newline><^END>

Related commands

SEGM{1-16}:VOLT command on page 414

SEGM:CURR:STAT command on page 402

SEGM:POW:STAT command on page 412

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Segment Table Menu - More - Osc Unit

SENS:CORR1

Format

SENSe:CORRection1[:STATe] {OFF|0}

SENSe:CORRection1[:STATe]?

Description

Resets the calibration data array and calibration coefficient array and turns off the calibration function. The calibration function cannot be set to on with this command.

Parameters

	Description
OFF or 0 (Default)	Turns off the calibration function.

Query response

{1|0}<newline><^END>

When confirming the status by Query, 1 is returned if the calibration function is on.

Related commands

SENS:CORR1:COLL:SAVE command on page 439

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Cal Menu - Cal Reset

SENS:CORR1:CKIT

Format

SENSe:CORRection1:CKIT {DEFault|PTFE|USER}

SENSe:CORRection1:CKIT?

Description

When measuring the calibration data, selects whether to use the 7-mm calibration kit supplied with the E4991A or a user-defined calibration kit prepared by the user.

Also, in the dielectric measurement, selects the Load standard attached by Agilent test fixture. When the dielectric measurement is selected, “PTFE” is selected automatically.

Parameters

For impedance measurement or magnetic measurement:

	Description
DEFault (Default)	Selects the 7-mm calibration kit supplied with E4991A.
USER	Selects the user-defined calibration kit.

For dielectric measurement:

	Description
PTFE	Selects the Load standard supplied with Agilent test fixture.

Query response

{DEF|PTFE|USER}<newline><^END>

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Cal Kit Menu - Cal Kit Type

SENS:CORR1:CKIT:LIST

Format

SENSe:CORRection1:CKIT:LIST[:STATe] {ON|OFF|1|0}

SENSe:CORRection1:CKIT:LIST[:STATe]?

Description

When using a user-defined calibration kit for executing calibration, selects whether to specify the input value with or without the list setting function for each standard value of the calibration kit.

When the list setting function is set to on, standard values inputted by the following commands are used at the time of calibration.

- **SENS:CORR1:CKIT:STAN1:LIST:G** command on page 425
- **SENS:CORR1:CKIT:STAN1:LIST:B** command on page 424
- **SENS:CORR1:CKIT:STAN2:LIST:R** command on page 427
- **SENS:CORR1:CKIT:STAN2:LIST:X** command on page 428
- **SENS:CORR1:CKIT:STAN3:LIST:R** command on page 431
- **SENS:CORR1:CKIT:STAN3:LIST:X** command on page 432

When the list setting function is set to off, standard values inputted by the following commands are used at the time of calibration.

- **SENS:CORR1:CKIT:STAN1:G** command on page 423
- **SENS:CORR1:CKIT:STAN1:C** command on page 422
- **SENS:CORR1:CKIT:STAN2:R** command on page 429
- **SENS:CORR1:CKIT:STAN2:L** command on page 426
- **SENS:CORR1:CKIT:STAN3:R** command on page 433
- **SENS:CORR1:CKIT:STAN3:L** command on page 430

Parameters

	Description
ON or 1*1	Sets the list setting function to on.
OFF or 0 (Default)	Sets the list setting function to off.

*1. This can only be used when measuring the calibration data in the user-defined frequency point/user-defined power point.

Query response

{1|0}<newline><^END>

Related commands

SENS:CORR1:CKIT command on page 420

SENS:CORR1:COLL:FPO command on page 438

Front Panel Equivalents

Unavailable.

SENS:CORR1:CKIT:STAN1:C

Format

SENSe:CORRection1:CKIT:STANdard1:C <numeric>

SENSe:CORRection1:CKIT:STANdard1:C?

Description

Defines the capacitance value (C) of the Open standard of a user-defined calibration kit.

Parameters

	<numeric>
Description	Capacitance value (C) of the Open standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	F

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SENS:CORR1:CKIT:LIST command on page 421

SENS:CORR1:CKIT:STAN1:G command on page 423

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Cal Kit Menu - Open C: (F)

SENS:CORR1:CKIT:STAN1:G

Format

SENSe:CORRection1:CKIT:STANdard1:G <numeric>

SENSe:CORRection1:CKIT:STANdard1:G?

Description

Defines the conductance value (G) of the Open standard of a user-defined calibration kit.

Parameters

	<numeric>
Description	Conductance value (G) of the Open standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	S (Siemens)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SENS:CORR1:CKIT:LIST command on page 421

SENS:CORR1:CKIT:STAN1:C command on page 422

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Cal Kit Menu - Open G: (S)

SENS:CORR1:CKIT:STAN1:LIST:B

Format

SENSe:CORRection1:CKIT:STANdard1:LIST:B <numeric 1>,<numeric 2>,..,<numeric N>

SENSe:CORRection1:CKIT:STANdard1:LIST:B?

Description

Defines the susceptance value (B) of the Open standard of a user-defined calibration kit with the list setting function.

When using the list setting function, the susceptance value (B) of the Open standard, defined for the calibration data throughout the entire frequency range, is set for the exact number of measurement points (N).

NOTE

The standard value defined with the list setting function can only be used when measuring the calibration data in the user-defined frequency point/user-defined power point.

Parameters

	<numeric n>
Description	Susceptance value (B) of the Open standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	S (Siemens)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric 1}, {numeric 2},.., {numeric N}<newline><^END>

Where N is the number of measurement points.

Related commands

SENS:CORR1:CKIT:LIST command on page 421

SENS:CORR1:CKIT:STAN1:LIST:G command on page 425

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

SENS:CORR1:CKIT:STAN1:LIST:G

Format

SENSe:CORRection1:CKIT:STANdard1:LIST:G <numeric 1>,<numeric 2>,..,<numeric N>

SENSe:CORRection1:CKIT:STANdard1:LIST:G?

Description

Defines the conductance value (G) of the Open standard of a user-defined calibration kit with the list setting function.

When using the list setting function, the conductance value (G) of the Open standard, defined for the calibration data throughout the entire frequency range, is set for the exact number of measurement points (N).

NOTE

The standard value defined with the list setting function can only be used when measuring the calibration data in the user-defined frequency point/user-defined power point.

Parameters

	<numeric n>
Description	Conductance value (G) of the Open standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	S (Siemens)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric1}, {numeric 2},.., {numeric N}<newline><^END>

Where N is the number of measurement points.

Related commands

SENS:CORR1:CKIT:LIST command on page 421

SENS:CORR1:CKIT:STAN1:C command on page 422

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

SENS:CORR1:CKIT:STAN2:L

Format

SENSe:CORRection1:CKIT:STANdard2:L <numeric>

SENSe:CORRection1:CKIT:STANdard2:L?

Description

Defines the inductance value (L) of the Short standard of a user-defined calibration kit.

Parameters

	<numeric>
Description	Inductance value (L) of the Short standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	H

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SENS:CORR1:CKIT:LIST command on page 421

SENS:CORR1:CKIT:STAN2:R command on page 429

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Cal Kit Menu - Short L: (H)

SENS:CORR1:CKIT:STAN2:LIST:R

Format

SENSe:CORRection1:CKIT:STANdard2:LIST:R <numeric 1>,<numeric 2>,..,<numeric N>

SENSe:CORRection1:CKIT:STANdard2:LIST:R?

Description

Defines the resistance value (R) of the Short standard of a user-defined calibration kit by using the list setting function.

When using the list setting function, the resistance value (R) of the Short standard, defined for the calibration data throughout the entire frequency range, is set for the exact number of measurement points (N).

NOTE

The standard value defined with the list setting function can only be used when measuring the calibration data in the user-defined frequency point/user-defined power point.

Parameters

	<numeric n>
Description	Resistance value (R) of the Short standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	Ω (ohm)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric 1}, {numeric 2},.., {numeric N}<newline><^END>

Where N is the number of measurement points.

Related commands

SENS:CORR1:CKIT:LIST command on page 421

SENS:CORR1:CKIT:STAN2:R command on page 429

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

SENS:CORR1:CKIT:STAN2:LIST:X

Format

SENSe:CORRection1:CKIT:STANdard2:LIST:X <numeric 1>,<numeric 2>,..,<numeric N>

SENSe:CORRection1:CKIT:STANdard2:LIST:X?

Description

Defines the reactance value (X) of the Short standard of a user-defined calibration kit by using the list setting function.

When using the list setting function, the reactance value (X) of the Short standard, defined for the calibration data throughout the entire frequency range, is set for the exact number of measurement points (N).

NOTE

The standard value defined by using the list setting function can only be used when measuring the calibration data in the user-defined frequency point/user-defined power point.

Parameters

	<numeric n>
Description	Reactance value (X) of the Short standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	Ω (ohm)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric 1}, {numeric 2},.., {numeric N}<newline><^END>

Where N is the number of measurement points.

Related commands

SENS:CORR1:CKIT:LIST command on page 421

SENS:CORR1:CKIT:STAN2:LIST:R command on page 427

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

SENS:CORR1:CKIT:STAN2:R

Format

SENSe:CORRection1:CKIT:STANdard2:R <numeric>

SENSe:CORRection1:CKIT:STANdard2:R?

Description

Defines the resistance value (R) of the Short standard of a user-defined calibration kit.

Parameters

	<numeric>
Description	Resistance value (R) of the Short standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	Ω (ohm)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SENS:CORR1:CKIT:LIST command on page 421

SENS:CORR1:CKIT:STAN2:L command on page 426

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Cal Kit Menu - Short R: (Ω)

SENS:CORR1:CKIT:STAN3:L

Format

SENSe:CORRection1:CKIT:STANdard3:L <numeric>

SENSe:CORRection1:CKIT:STANdard3:L?

Description

Defines the inductance value (L) of the Load standard of a user-defined calibration kit.

Parameters

	<numeric>
Description	Inductance value (L) of the Load standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	H

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SENS:CORR1:CKIT:LIST command on page 421

SENS:CORR1:CKIT:STAN3:R command on page 433

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Cal Kit Menu - Load L: (H)

SENS:CORR1:CKIT:STAN3:LIST:R

Format

SENSe:CORRection1:CKIT:STANdard3:LIST:R <numeric 1>,<numeric 2>,..,<numeric N>

SENSe:CORRection1:CKIT:STANdard3:LIST:R?

Description

Defines the resistance value (R) of the Load standard of a user-defined calibration kit by using the list setting function.

When using the list setting function, the resistance value (R) of the Load standard, defined for the calibration data throughout the entire frequency range, is set for the exact number of measurement points (N).

NOTE

The standard value defined by using the list setting function can only be used when measuring the calibration data in the user-defined frequency point/user-defined power point.

Parameters

	<numeric n>
Description	Resistance value (R) of the Load standard
Data type	Floating point
Range	-1E6 to 1E6
Default	50
Unit	Ω (ohm)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric 1}, {numeric 2},.., {numeric N}<newline><^END>

Where N is the number of measurement points.

Related commands

SENS:CORR1:CKIT:LIST command on page 421

SENS:CORR1:CKIT:STAN3:LIST:X command on page 432

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

SENS:CORR1:CKIT:STAN3:LIST:X

Format

SENSe:CORRection1:CKIT:STANdard3:LIST:X <numeric 1>,<numeric 2>,..,<numeric N>

SENSe:CORRection1:CKIT:STANdard3:LIST:X?

Description

Defines the reactance value (X) of the Load standard of a user-defined calibration kit by using the list setting function.

When using the list setting function, reactance value (X) of the Load standard, defined for the calibration data throughout the entire frequency range, is set for the exact number of measurement points (N).

NOTE

The standard value defined by using the list setting function is available only when measuring the calibration data in the user-defined frequency point/user-defined power point.

Parameters

	<numeric n>
Description	Reactance value (X) of the Load standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	Ω (ohm)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric 1}, {numeric 2},.., {numeric N}<newline><^END>

Where N is the number of measurement points.

Related commands

SENS:CORR1:CKIT:LIST command on page 421

SENS:CORR1:CKIT:STAN3:LIST:R command on page 431

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

SENS:CORR1:CKIT:STAN3:R

Format

SENSe:CORRection1:CKIT:STANdard3:R <numeric>

SENSe:CORRection1:CKIT:STANdard3:R?

Description

Defines the resistance value (R) of the Load standard of a user-defined calibration kit.

Parameters

	<numeric>
Description	Resistance value (R) of the Load standard
Data type	Floating point
Range	-1E6 to 1E6
Default	50
Unit	Ω (ohm)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SENS:CORR1:CKIT:LIST command on page 421

SENS:CORR1:CKIT:STAN3:L command on page 430

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Cal Kit Menu - Load R: (Ω)

SENS:CORR1:CKIT:STAN7:PLF

Format

SENSe:CORRection1:CKIT:STANdard7:PLFactor <numeric>

SENSe:CORRection1:CKIT:STANdard7:PLFactor?

Description

Defines the dielectric dissipation factor of the Load standard of the calibration kit in dielectric measurement. This command can be used when Option 002 (material measurement software) is installed.

Parameters

	<numeric>
Description	Dielectric dissipation factor of the Load standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SENS:CORR1:CKIT:STAN7:PRE command on page 435

SENS:CORR1:CKIT:STAN7:THIC command on page 436

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Cal Kit Menu - εr Loss

SENS:CORR1:CKIT:STAN7:PRE

Format

SENSe:CORRection1:CKIT:STANdard7:PREal <numeric>

SENSe:CORRection1:CKIT:STANdard7:PREal?

Description

Defines the dielectric constant ratio of the Load standard of the calibration kit in dielectric measurement. This command can be used when Option 002 (material measurement software) is installed.

Parameters

	<numeric>
Description	Dielectric constant ratio of the Load standard
Data type	Floating point
Range	-1E6 to 1E6
Default	2.1

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SENS:CORR1:CKIT:STAN7:PLF command on page 434

SENS:CORR1:CKIT:STAN7:THIC command on page 436

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Cal Kit Menu - εr Real

SENS:CORR1:CKIT:STAN7:THIC

Format

SENSe:CORRection1:CKIT:STANdard7:THICkness <numeric>

SENSe:CORRection1:CKIT:STANdard7:THICkness?

Description

Defines the thickness of the Load standard of the calibration kit in dielectric measurement. This command can be used when Option 002 (material measurement software) is installed.

Parameters

	<numeric>
Description	Thickness of the Load standard
Data type	Floating point
Range	-1E6 to 1E6
Default	800E-6
Unit	m (meter)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SENS:CORR1:CKIT:STAN7:PLF command on page 434

SENS:CORR1:CKIT:STAN7:PRE command on page 435

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Cal Kit Menu - Thickness

SENS:CORR1:COLL

Format

SENSe:CORRection1:COLLect[:ACQuire]
{STAN1|STAN2|STAN3|STAN4|STAN5|STAN6|STAN7}

Description

Measures calibration data. (No query)

Parameters

For impedance measurement or magnetic measurement:

	Description
STAN1	Open calibration data is measured.
STAN2	Short calibration data is measured.
STAN3	Load calibration data is measured.
STAN4	Low-loss capacitor calibration data is measured.

For dielectric measurement:

	Description
STAN5	Open calibration data is measured.
STAN6	Short calibration data is measured.
STAN7	Load calibration data is measured.

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Cal Menu - Meas Open|Meas Short|Meas Load|Meas Low Loss C(Optional)

SENS:CORR1:COLL:FPO

Format

SENSe:CORRection1:COLLect:FPOints {FIXed|FUSer|USER}

SENSe:CORRection1:COLLect:FPOints?

Description

Selects whether to measure the calibration data at the measurement point prepared by the E4991A (fixed point) or at the measurement point set by the user (user-defined point). In addition, the measurement point of the calibration data is linked with the measurement point of the fixture compensation data selected with the **SENS:CORR2:COLL:FPO** command.

Parameters

	Description
FIXed (Default)	The calibration data is measured at the fixed frequency point and over the entire oscillator level range prepared by the E4991A's "Fixed frequency/fixed power points." After execution of calibration, the calibration function is valid even if the measured frequency and oscillator level are altered.
FUSer	The calibration data is measured by the combination of the fixed frequency point prepared by the E4991A and the oscillator level value set by the user's "Fixed frequency/user-defined power points." In addition, this measurement point can be selected when frequency linear/log sweep is selected as the sweep type. After execution of calibration, the calibration function is disabled if the oscillator level is altered.
USER	The calibration data is measured at the frequency point set by the user and the oscillator level's "User-defined frequency/user-defined power points." After execution of calibration, the calibration function is disabled if the measured frequency or the oscillator level is altered.

Query response

{FIX|FUS|USER}<newline><^END>

Related commands

SENS:CORR2:COLL:FPO command on page 450

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Cal Menu - Cal Type

SENS:CORR1:COLL:SAVE

Format	SENSe:CORRection1:COLLect:SAVE
Description	By using the acquired calibration data, calculates the calibration coefficient and automatically sets the calibration function to on. If this command is used before measuring all of the calibration data of Open, Short, and Load with the **SENS:CORR1:COLL** command, an error will occur and the command will be ignored. (No query)
Related commands	**SENS:CORR1:COLL** command on page 437 **SENS:CORR1** command on page 419
Front Panel Equivalents	**Stimulus** - **Cal/Comp...** - Cal Menu - Done

SENS:CORR2:CKIT:LIST

Format

SENSe:CORRection2:CKIT:LIST[:STATe] {ON|OFF|1|0}

SENSe:CORRection2:CKIT:LIST[:STATe]?

Description

When executing fixture compensation with the fixture compensation kit, selects whether to specify the input value with or without using the list setting function on each standard value of the fixture compensation kit.

When the list setting function is set to on, standard values inputted with the following commands are used at the time of fixture compensation.

- **SENS:CORR2:CKIT:STAN1:LIST:G** command on page 444
- **SENS:CORR2:CKIT:STAN1:LIST:B** command on page 443
- **SENS:CORR2:CKIT:STAN2:LIST:R** command on page 446
- **SENS:CORR2:CKIT:STAN2:LIST:X** command on page 447

When the list setting function is set to off, standard values inputted with the following commands are used at the time of fixture compensation.

- **SENS:CORR2:CKIT:STAN1:G** command on page 442
- **SENS:CORR2:CKIT:STAN1:C** command on page 441
- **SENS:CORR2:CKIT:STAN2:R** command on page 448
- **SENS:CORR2:CKIT:STAN2:L** command on page 445

Parameters

	Description
ON or 1*1	Sets the list setting function to on.
OFF or 0 (Default)	Sets the list setting function to off.

*1. This can be used only when measuring the fixture compensation data in the user-defined frequency point/user-defined power point.

Query response

{1|0}<newline><^END>

Related commands

SENS:CORR2:COLL:FPO command on page 450

Front Panel Equivalents

Unavailable.

SENS:CORR2:CKIT:STAN1:C

Format

SENSe:CORRection2:CKIT:STANdard1:C <numeric>

SENSe:CORRection2:CKIT:STANdard1:C?

Description

Defines the capacitance value (C) of the Open standard of the fixture compensation kit.

Parameters

	<numeric>
Description	Capacitance value (C) of the Open standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	F

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SENS:CORR2:CKIT:LIST command on page 440

SENS:CORR2:CKIT:STAN1:G command on page 442

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Cal Kit Menu - Open C: (F)

SENS:CORR2:CKIT:STAN1:G

Format

SENSe:CORRection2:CKIT:STANdard1:G <numeric>

SENSe:CORRection2:CKIT:STANdard1:G?

Description

Defines the conductance value (G) of the Open standard of the fixture compensation kit.

Parameters

	<numeric>
Description	Conductance value (G) of the Open standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	S (Siemens)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SENS:CORR2:CKIT:LIST command on page 440

SENS:CORR2:CKIT:STAN1:C command on page 441

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Comp Kit Menu - Open G: (S)

SENS:CORR2:CKIT:STAN1:LIST:B

Format

SENSe:CORRection2:CKIT:STANdard1:LIST:B <numeric 1>,<numeric 2>,..,<numeric N>

SENSe:CORRection2:CKIT:STANdard1:LIST:B?

Description

Defines the susceptance value (B) of the Open standard of the fixture compensation kit by using the list setting function.

When using the list setting function, the susceptance value (B) of the Open standard, defined for the calibration data throughout the entire frequency range, is set for the exact number of measurement points (N).

NOTE

The standard value defined by the list setting function can be used when measuring the fixture compensation data in the user-defined frequency point/user-defined power point.

Parameters

	<numeric n>
Description	Susceptance value (B) of the Open standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	S (Siemens)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric 1}, {numeric 2},.., {numeric N}<newline><^END>

Where N is the number of measurement points.

Related commands

SENS:CORR2:CKIT:LIST command on page 440

SENS:CORR2:CKIT:STAN1:LIST:G command on page 444

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

SENS:CORR2:CKIT:STAN1:LIST:G

Format

SENSe:CORRection2:CKIT:STANdard1:LIST:G <numeric 1>,<numeric 2>,..,<numeric N>

SENSe:CORRection2:CKIT:STANdard1:LIST:G?

Description

Defines the conductance value (G) of the Open standard of the fixture compensation kit by using the list setting function..

When using the list setting function, the conductance value (G) of the Open standard, defined for the calibration data throughout the entire frequency range, is set for the exact number of measurement points (N).

NOTE

The standard value defined by the list setting function can be used when measuring the fixture compensation data in the user-defined frequency point/user-defined power point.

Parameters

	<numeric n>
Description	Conductance value (G) of the Open standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	S (Siemens)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric 1}, {numeric 2},.., {numeric N}<newline><^END>

Where N is the number of measurement points.

Related commands

SENS:CORR2:CKIT:LIST command on page 440

SENS:CORR2:CKIT:STAN1:LIST:B command on page 443

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

SENS:CORR2:CKIT:STAN2:L

Format

SENSe:CORRection2:CKIT:STANdard2:L <numeric>

SENSe:CORRection2:CKIT:STANdard2:L?

Description

Defines the inductance value (L) of the Short standard of the fixture compensation kit.

Parameters

	<numeric>
Description	Inductance value (L) of the Short standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	H

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SENS:CORR2:CKIT:LIST command on page 440

SENS:CORR2:CKIT:STAN2:R command on page 448

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Comp Kit Menu - Short L: (H)

SENS:CORR2:CKIT:STAN2:LIST:R

Format

SENSe:CORRection2:CKIT:STANdard2:LIST:R <numeric 1>,<numeric 2>,..,<numeric N>

SENSe:CORRection2:CKIT:STANdard2:LIST:R?

Description

Defines the resistance value (R) of the Short standard of the fixture compensation kit by using the list setting function.

When using the list setting function, the resistance value (R) of the Short standard, defined for the calibration data throughout the entire frequency range, is set for the exact number of measurement points (N).

NOTE

The standard value defined by the list setting function can be used when measuring the fixture compensation data in the user-defined frequency point/user-defined power point.

Parameters

	<numeric n>
Description	Resistance value (R) of the Short standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	Ω (ohm)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric 1}, {numeric 2},.., {numeric N}<newline><^END>

Where N is the number of measurement points.

Related commands

SENS:CORR2:CKIT:LIST command on page 440

SENS:CORR2:CKIT:STAN2:LIST:X command on page 447

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

SENS:CORR2:CKIT:STAN2:LIST:X

Format

SENSe:CORRection2:CKIT:STANdard2:LIST:X <numeric 1>,<numeric 2>,..,<numeric N>

SENSe:CORRection2:CKIT:STANdard2:LIST:X?

Description

Defines the reactance value (X) of the Short standard of the fixture compensation kit by using the list setting function.

When using the list setting function, the reactance value (X) of the Short standard, defined for the calibration data throughout the entire frequency range, is set for the exact number of measurement points (N).

NOTE

The standard value defined by the list setting function can be used when measuring the fixture compensation data in the user-defined frequency point/user-defined power point.

Parameters

	<numeric n>
Description	Reactance value (X) of the Short standard
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	Ω (ohm)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric 1}, {numeric 2},.., {numeric N}<newline><^END>

Where N is the number of measurement points.

Related commands

SENS:CORR2:CKIT:LIST command on page 440

SENS:CORR2:CKIT:STAN2:LIST:R command on page 446

FORM:DATA command on page 374

Front Panel Equivalents

Unavailable.

SENS:CORR2:CKIT:STAN2:R

Format

SENSe:CORRection2:CKIT:STANdard2:R <numeric>

SENSe:CORRection2:CKIT:STANdard2:R?

Description

Defines the resistance value (R) of the Short standard of the fixture compensation kit.

Parameters

	<numeric>
Description	Resistance value of the Short standard (R)
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	Ω (ohm)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SENS:CORR2:CKIT:LIST command on page 440

SENS:CORR2:CKIT:STAN2:L command on page 445

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Comp Kit Menu - Short R: (Ω)

SENS:CORR2:COLL

Format

SENSe:CORRection2:COLLect[:ACQuire] {STAN1|STAN2|STAN9}

Description

Measures fixture compensation data. (No query)

Parameters

For impedance measurement:

	Description
STAN1	Open compensation data is measured.
STAN2	Short compensation data is measured.

For magnetic measurement:

	Description
STAN9	Short compensation data is measured.

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Comp Menu - Meas Open|Meas Short

SENS:CORR2:COLL:FPO

Format

SENSe:CORRection2:COLLect:FPOints {FIXed|FUSer|USER}

SENSe:CORRection2:COLLect:FPOints?

Description

Selects whether to measure the fixture compensation data at the measurement point prepared by the E4991A (fixed point) or at the measurement point set by the user (user-defined point). In addition, the measurement point of the compensation data is linked with the measurement point of the calibration data selected with the **SENS:CORR1:COLL:FPO** command.

Parameters

	Description
FIXed (Default)	The fixture compensation data is measured at the fixed frequency point and over the entire oscillator level range prepared by the E4991A's "Fixed frequency/fixed power points." After execution of fixture compensation, the fixture compensation function is valid even if the measured frequency and oscillator level are altered.
FUSer	The fixture compensation data is measured by the combination of the fixed frequency point prepared by the E4991A and the oscillator level value set by the user's "Fixed frequency/user-defined power points." In addition, this measurement point can be selected when frequency linear/log sweep is selected as the sweep type. After execution of fixture compensation, the fixture compensation function is disabled if the oscillator level is altered. (In addition, since the calibration function is disabled, the measurement of calibration data needs to be re-executed.)
USER	The fixture compensation data is measured at the frequency point set by the user and the oscillator level's "User-defined frequency/user-defined power points." After execution of fixture compensation, the fixture compensation function is disabled if the measured frequency or the oscillator level is altered. (In addition, since calibration is disabled, calibration needs to be re-executed.)

Query response

{FIX|FUS|USER}<newline><^END>

Related commands

SENS:CORR1:COLL:FPO command on page 438

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Cal Menu - Cal Type

SENS:CORR2:COLL:OPEN

Format

SENSe:CORRection2:COLLect:OPEN[:STATe] {ON|OFF|1|0}

SENSe:CORRection2:COLLect:OPEN[:STATe]?

Description

Turns on/off the Open compensation function. At this time, the fixture compensation coefficient is re-calculated. If this command is executed before measuring the Open compensation data with the **SENS:CORR2:COLL** command, an error will occur and the command will be ignored.

Parameters

	Description
ON or 1	Turns on the Open compensation function.
OFF or 0 (Default)	Turns off the Open compensation function.

Query response

{1|0}<newline><^END>

Related commands

SENS:CORR2:COLL command on page 449

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Comp Menu - Comp Open [On/Off]

SENS:CORR2:COLL:SAVE

Format

SENSe:CORRection2:COLLect:SAVE

Description

Calculates the fixture compensation coefficient and sets the fixture compensation function to on. If this command is executed before measuring the fixture compensation data with the **SENS:CORR2:COLL** command, an error will occur and the command will be ignored. (No query)

Related commands

SENS:CORR2:COLL command on page 449

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Comp Menu - Done

SENS:CORR2:COLL:SHOR

Format

SENSe:CORRection2:COLLect:SHORt[:STATe] {ON|OFF|1|0}

SENSe:CORRection2:COLLect:SHORt[:STATe]?

Description

Turns on/off the Short compensation function. At this time, the fixture compensation coefficient is re-calculated. If this command is executed before measuring the Short compensation data with the **SENS:CORR2:COLL** command, an error will occur and the command will be ignored.

Parameters

	Description
ON or 1	Turns on the Short compensation function.
OFF or 0 (Default)	Turns off the Short compensation function.

Query response

{1|0}<newline><^END>

Related commands

SENS:CORR2:COLL command on page 449

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Comp Menu - Comp Short [On/Off]

SENS:CORR2:EDEL:TIME

Format

SENSe:CORRection2:EDELay:TIME <numeric>

SENSe:CORRection2:EDELay:TIME?

Description

If there is an error related to port extension, aside from electrical length of the test fixture, an offset delay time is set and compensated.

Parameters

	<numeric>
Description	Offset delay time
Data type	Floating point
Range	-1E6 to 1E6
Default	0
Unit	S (seconds)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Port Extension: (Sec)

SENS:CORR2:FIXT

Format

SENSe:CORRection2:FIXTure {NONE|FXT16191A|FXT16192A|FXT16193A|FXT16194A|FXT16196A|FXT16196B|FXT16196C|FXT16197A|FXT16453A|FXT16454S|FXT16454L|USER}

SENSe:CORRection2:FIXTure?

Description

Selects the test fixture.

Parameters

	Description
NONE (Default in impedance measurement)	No test fixture is selected.
FXT16191A	Specifies Agilent 16191A.
FXT16192A	Specifies Agilent 16192A.
FXT16193A	Specifies Agilent 16193A.
FXT16194A	Specifies Agilent 16194A.
FXT16196A	Specifies Agilent 16196A.
FXT16196B	Specifies Agilent 16196B.
FXT16196C	Specifies Agilent 16196C.
FXT16197A	Specifies Agilent 16197A.
FXT16453A*1	Specifies Agilent 16453A.
FXT16454S*2(Default in magnetic measurement)	Specifies Agilent 16454S.
FXT16454L*2	Specifies Agilent 16454L.
USER*3	Specifies the test fixture created by user (custom test fixture).

*1. Only in electric mode.
*2. Only in magnetic mode.
*3. When using the custom test fixture, it is necessary to compensate the electrical length error with the **SENS:CORR2:FIXT:EDEL:USER:DIST** command.

Query response

{NONE|FXT16191A|FXT16192A|FXT16193A|FXT16194A|FXT16196A|FXT16196B|FXT16196C|FXT16197A|FXT16453A|FXT16454S|FXT16454L|USER}<newline><^END>

Related commands

SENS:CORR2:FIXT:EDEL:USER:DIST command on page 456

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Fixture Type

SENS:CORR2:FIXT:EDEL:MODE:DIST?

Format

SENSe:CORRection2:FIXTure:EDELay:MODEl:DISTance? {NONE|FXT16191A|FXT16192A|FXT16193A|FXT16194A|FXT16196A|FXT16196B|FXT16196C|FXT16197A}

Description

Reads the standard value of the electrical length of the specified Agilent test fixture. (Query only)

Parameters

	Description
NONE	No test fixture is selected.
FXT16191A	Specifies Agilent 16191A.
FXT16192A	Specifies Agilent 16192A.
FXT16193A	Specifies Agilent 16193A.
FXT16194A	Specifies Agilent 16194A.
FXT16196A	Specifies Agilent 16196A.
FXT16196B	Specifies Agilent 16196B.
FXT16196C	Specifies Agilent 16196C.
FXT16197A	Specifies Agilent 16197A.

Query response

{numeric}<newline><^END>

Numeric of the floating point is sensed.

Related commands

SENS:CORR2:FIXT command on page 454

Front Panel Equivalents

Unavailable.

SENS:CORR2:FIXT:EDEL:USER:DIST

Format

SENSe:CORRection2:FIXTure:EDELay:USER:DISTance <numeric>

SENSe:CORRection2:FIXTure:EDELay:USER:DISTance?

Description

Sets the electrical length that compensates for the delay caused by the connection of a custom test fixture. If you want to configure the instrument for your custom test fixture connected to the DUT PORT, use this command to set an electrical length that can compensate for the resulting delay.

Parameters

	<numeric>
Description	Electrical length
Data type	Floating point
Range	-1E3 to 1E3
Default	0
Unit	m (meter)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SENS:CORR2:FIXT command on page 454

Front Panel Equivalents

Stimulus - **Cal/Comp...** - Fixture Length: (m)

SOUR:CURR

Format

SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude] <numeric>

SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]?

Description

Sets the oscillator current level when the sweep parameter is set to frequency sweep, dc bias voltage sweep, or dc bias current sweep.

Parameters

	<numeric>
Description	Oscillator current level
Data type	Floating point
Range	0.1E-3 to 10E-3
Default	2.0E-3
Resolution	0.01E-3
Unit	A (ampere)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:CURR:MODE command on page 460

Front Panel Equivalents

Stimulus - **Source...** - OSC Level: A

SOUR:CURR:CENT

Format

SOURce:CURRent:CENTer <numeric>

SOURce:CURRent:CENTer?

Description

Sets the center value in the oscillator current level sweep range.

In addition, use the **SOUR:CURR:SPAN** command to set the span value in the sweep range.

Parameters

	<numeric>
Description	Center value in the sweep range
Data type	Floating point
Range	0.1E-3 to 10E-3
Default	6.0E-3
Resolution	0.01E-3
Unit	A (ampere)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:CURR:MODE command on page 460

SOUR:CURR:SPAN command on page 467

Front Panel Equivalents

Stimulus - **Start/Stop...** - Center: A

SOUR:CURR:LIM:OFFS

Format

SOURce:CURRent:LIMit:OFFSet <numeric>

SOURce:CURRent:LIMit:OFFSet?

Description

Sets the dc bias current limit maximum value when the dc bias output mode is set to the voltage sweep mode or the fixed voltage source mode. This command can be used when Option 001 (dc bias function) is installed.

Parameters

	<numeric>
Description	dc bias current limit maximum value
Data type	Floating point
Range	2E-3 to 50E-3
Default	2E-3
Resolution	0.01E-3
Unit	A (ampere)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

Stimulus - **Source...** - Bias Limit: A

SOUR:CURR:MODE

Format

SOURce:CURRent:MODE {FIXed|SWEep}

SOURce:CURRent:MODE?

Description

Selects the oscillator current level mode.

Parameters

	Description
FIXed (Default)	Specifies the fixed current mode.
SWEep	Specifies the current sweep mode.

Query response

{FIX|SWE}<newline><^END>

Related commands

SWE:TYPE command on page 515

SOUR:POW:MODE command on page 472

SOUR:VOLT:MODE command on page 479

Front Panel Equivalents

Stimulus - **Source...** - Osc Unit

SOUR:CURR:OFFS

Format

SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet <numeric>

SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet?

Description

Sets the dc bias current level in the fixed current source mode. This command can be used when Option 001 (dc bias function) is installed.

Parameters

	<numeric>
Description	dc bias current level
Data type	Floating point
Range	-50E-3 to -100E-6, 100E-6 to 50E-3
Default	100E-6
Resolution	10E-6
Unit	A (ampere)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Front Panel Equivalents

Stimulus - **Source...** - Bias Level: A

SOUR:CURR:OFFS:CENT

Format

SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet:CENTer <numeric>

SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet:CENTer?

Description

Sets the center value in the dc bias current sweep range. This command can be used when Option 001 (dc bias function) is installed.

In addition, in order to set the span value of the sweep range, the **SOUR:CURR:OFFS:SPAN** command is used.

Parameters

	<numeric>
Description	Center value in the sweep range
Data type	Floating point
Range	-50E-3 to 50E-3-3
Default	100E-6
Resolution	10E-6
Unit	A (ampere)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:CURR:OFFS:SPAN command on page 463

Front Panel Equivalents

Stimulus - **Start/Stop...** - Center: A

SOUR:CURR:OFFS:SPAN

Format

SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet:SPAN <numeric>

SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet:SPAN?

Description

Sets the span value in the dc bias current sweep range. This command can be used when Option 001 (dc bias function) is installed.

In addition, use the **SOUR:CURR:OFFS:CENT** command to set the center value of the sweep range.

Parameters

	<numeric>
Description	Span value in the sweep range
Data type	Floating point
Range	0 to 100E-3
Default	0
Resolution	10E-6
Unit	A (ampere)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:CURR:OFFS:CENT command on page 462

Front Panel Equivalents

Stimulus - **Start/Stop...** - Span: A

SOUR:CURR:OFFS:STAR

Format

SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STARt <numeric>

SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STARt?

Description

Sets the start value in the dc bias current sweep range. This command can be used when Option 001 (dc bias function) is installed.

In addition, use the **SOUR:CURR:OFFS:STOP** command to set the stop value of the sweep range.

Parameters

	<numeric>
Description	Start value in the sweep range
Data type	Floating point
Range	-50E-3 to 50E-3
Default	100E-6
Resolution	10E-6
Unit	A (ampere)

Query response

{numeric}<newline><^END>

Related commands

SOUR:CURR:OFFS:STOP command on page 466

Front Panel Equivalents

Stimulus - **Start/Stop...** - Start: A

SOUR:CURR:OFFS:STAT

Format

SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STATe {ON|OFF|1|0}

SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STATe?

Description

Turns on/off the dc bias output in the current sweep mode or the fixed current source mode. This command can be used when Option 001 (dc bias function) is installed.

Parameters

	Description
ON or 1	Turn on the dc bias output.*1
OFF or 0 (Default)	Turn off the dc bias output.

*1. When the dc bias is turned on from off, the sweep mode is automatically set to hold.

Query response

{1|0}<newline><^END>

Related commands

SOUR:VOLT:OFFS:STAT command on page 484

Front Panel Equivalents

Stimulus - **Source...** - dc bias: [On/Off]

SOUR:CURR:OFFS:STOP

Format

SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STOP <numeric>

SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STOP?

Description

Sets the stop value in the dc bias current sweep range. This command can be used when Option 001 (dc bias function) is installed.

In addition, use the **SOUR:CURR:OFFS:STAR** command to set the start value in the sweep range.

Parameters

	<numeric>
Description	Stop value in the sweep range
Data type	Floating point
Range	-50E-3 to 50E-3
Default	100E-6
Resolution	10E-6
Unit	A (ampere)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:CURR:OFFS:STAR command on page 464

Front Panel Equivalents

Stimulus - **Start/Stop...** - Stop: A

SOUR:CURR:SPAN

Format

SOURce:CURRent:SPAN <numeric>

SOURce:CURRent:SPAN?

Description

Sets the span value in the oscillator current level sweep range.

In addition, use the **SOUR:CURR:CENT** command to set the center value of the sweep range.

Parameters

	<numeric>
Description	Span value in the sweep range
Data type	Floating point
Range	0 to 9.9E-3
Default	4E-3
Resolution	0.01E-3
Unit	A (ampere)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:CURR:MODE command on page 460

SOUR:CURR:CENT command on page 458

Front Panel Equivalents

Stimulus - **Start/Stop...** - Span: A

SOUR:CURR:STAR

Format

SOURce:CURRent:STARt <numeric>

SOURce:CURRent:STARt?

Description

Sets the start value in the oscillator current level sweep range.

In addition, use the **SOUR:CURR:STOP** command to set the stop value of the sweep range.

Parameters

	<numeric>
Description	Start value in the sweep range
Data type	Floating point
Range	0.1 to 10E-3
Default	4E-3
Resolution	0.01E-3
Unit	A (ampere)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:CURR:MODE command on page 460

SOUR:CURR:STOP command on page 469

Front Panel Equivalents

Stimulus - **Start/Stop...** - Start: A

SOUR:CURR:STOP

Format

SOURce:CURRent:STOP <numeric>

SOURce:CURRent:STOP?

Description

Sets the stop value in the oscillator current level sweep range.

In addition, use the **SOUR:CURR:STAR** command to set the start value of the sweep range.

Parameters

	<numeric>
Description	Stop value in the sweep range
Data type	Floating point
Range	0.1 to 10E-3
Default	8E-3
Resolution	0.01E-3
Unit	A (ampere)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:CURR:MODE command on page 460

SOUR:CURR:STAR command on page 468

Front Panel Equivalents

Stimulus - **Start/Stop...** - Stop: A

SOUR:POW

Format

SOURce:POWer[:LEVel][:IMMediate][:AMPLitude] <numeric>

SOURce:POWer[:LEVel][:IMMediate][:AMPLitude]?

Description

Sets the oscillator power level when the sweep parameter is set to frequency sweep, dc bias voltage sweep, or dc bias current sweep.

Parameters

	<numeric>
Description	Oscillator power level
Data type	Floating point
Range	-40 to 1
Default	-13.01
Unit	dBm

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:POW:MODE command on page 472

Front Panel Equivalents

Stimulus - **Source...** - OSC Level: dBm

SOUR:POW:CENT

Format

SOURce:POWer:CENTer <numeric>

SOURce:POWer:CENTer?

Description

Sets the center value in the oscillator power level sweep range.

In addition, use the **SOUR:POW:SPAN** command to set the span value of the sweep range.

Parameters

	<numeric>
Description	Center value in the sweep range
Data type	Floating point
Range	-40 to 1
Default	-3.9794
Unit	dBm

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:POW:MODE command on page 472

SOUR:POW:SPAN command on page 473

Front Panel Equivalents

Stimulus - **Start/Stop...** - Center: dBm

SOUR:POW:MODE

Format

SOURce:POWer:MODE {FIXed|SWEep}

SOURce:POWer:MODE?

Description

Selects the oscillator power level mode.

Parameters

	Description
FIXed (Default)	Specifies the fixed power mode.
SWEep	Specifies the power sweep mode.

Query response

{FIX|SWE}<newline><^END>

Related commands

SWE:TYPE command on page 515

SOUR:CURR:MODE command on page 460

SOUR:VOLT:MODE command on page 479

Front Panel Equivalents

Stimulus - **Source...** - OSC Unit

SOUR:POW:SPAN

Format

SOURce:POWer:SPAN <numeric>

SOURce:POWer:SPAN?

Description

Sets the span value in the oscillator power level sweep range.

In addition, use the **SOUR:POW:CENT** command to set the center value of the sweep range.

Parameters

	<numeric>
Description	Span value in the sweep range
Data type	Floating point
Range	0 to 41
Default	6.0206
Unit	dBm

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:POW:MODE command on page 472

SOUR:POW:CENT command on page 471

Front Panel Equivalents

Stimulus - **Start/Stop...** - Span: dBm

SOUR:POW:STAR

Format

SOURce:POWer:STARt <numeric>

SOURce:POWer:STARt?

Description

Sets the start value in the oscillator power level sweep range.

In addition, use the **SOUR:POW:STOP** command to set the stop value of the sweep range.

Parameters

	<numeric>
Description	Start value in the sweep range
Data type	Floating point
Range	-40 to 1
Default	-6.9897
Unit	dBm

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:POW:MODE command on page 472

SOUR:POW:STOP command on page 475

Front Panel Equivalents

Stimulus - **Start/Stop...** - Start: dBm

SOUR:POW:STOP

Format

SOURce:POWer:STOP <numeric>

SOURce:POWer:STOP?

Description

Sets the stop value in the oscillator power level sweep range.

In addition, use the **SOUR:POW:STAR** command to set the start value of the sweep range.

Parameters

	<numeric>
Description	Stop value in the sweep range
Data type	Floating point
Range	-40 to 1
Default	-0.9691
Unit	dBm

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:POW:MODE command on page 472

SOUR:POW:STAR command on page 474

Front Panel Equivalents

Stimulus - **Start/Stop...** - Stop: dBm

SOUR:VOLT

Format

SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude] <numeric>

SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]?

Description

Sets the oscillator voltage level when the sweep parameter is set to frequency sweep, dc bias voltage sweep, or dc bias current sweep.

Parameters

	<numeric>
Description	Oscillator voltage level
Data type	Floating point
Range	5E-3 to 502E-3
Default	100E-3
Resolution	1E-3
Unit	V (voltage)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:VOLT:MODE command on page 479

Front Panel Equivalents

Stimulus - **Source...** - OSC Level: V

SOUR:VOLT:CENT

Format

SOURce:VOLTage:CENTer <numeric>

SOURce:VOLTage:CENTer?

Description

Sets the center value in the oscillator voltage level sweep range.

In addition, use the **SOUR:VOLT:SPAN** command to set the span value of the sweep range.

Parameters

	<numeric>
Description	Center value in the sweep range
Data type	Floating point
Range	5E-3 to 502E-3
Default	300E-3
Resolution	1E-3
Unit	V (volt)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:VOLT:MODE command on page 479

SOUR:VOLT:SPAN command on page 486

Front Panel Equivalents

Stimulus - **Start/Stop...** - Center: V

SOUR:VOLT:LIM:OFFS

Format

SOURce:VOLTage:LIMit:OFFSet <numeric>

SOURce:VOLTage:LIMit:OFFSet?

Description

Sets the maximum value of the dc bias voltage limit when the dc bias output mode is set to current sweep mode or fixed current source mode. This command is available when Option 001 (dc bias function) is installed.

Parameters

	<numeric>
Description	dc bias voltage limit maximum value
Data type	Floating point
Range	1 to 40
Default	1
Resolution	1E-3
Unit	V (volt)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Front Panel Equivalents

Stimulus - **Source...** - Bias Limit: V

SOUR:VOLT:MODE

Format

SOURce:VOLTage:MODE {FIXed|SWEep}

SOURce:VOLTage:MODE?

Description

Selects the oscillator voltage level mode.

Parameters

	Description
FIXed (Default)	Specifies the fixed voltage mode.
SWEep	Specifies the voltage sweep mode.

Query response

{FIX|SWE}<newline><^END>

Related commands

SWE:TYPE command on page 515

SOUR:CURR:MODE command on page 460

SOUR:POW:MODE command on page 472

Front Panel Equivalents

Stimulus - **Source...** - Osc Unit

SOUR:VOLT:OFFS

Format

SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet <numeric>

SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet?

Description

Sets the dc bias voltage level in the fixed voltage source mode. This command can be used when Option 001 (dc bias function) is installed.

Parameters

	<numeric>
Description	dc bias voltage level
Data type	Floating point
Range	-40 to 40
Default	0
Resolution	1E-3
Unit	V (volt)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Front Panel Equivalents

Stimulus - **Source...** - Bias Level: V

SOUR:VOLT:OFFS:CENT

Format

SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet:CENTer <numeric>

SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet:CENTer?

Description

Sets the center value in the dc bias voltage sweep range. This command can be used when Option 001 (dc bias function) is installed.

In addition, use the **SOUR:VOLT:OFFS:SPAN** command to set the span value of the sweep range.

Parameters

	<numeric>
Description	Center value in the sweep range
Data type	Floating point
Range	-40 to 40
Default	0
Resolution	1E-3
Unit	V (volt)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:VOLT:OFFS:SPAN command on page 482

Front Panel Equivalents

Stimulus - **Start/Stop...** - Center: V

SOUR:VOLT:OFFS:SPAN

Format

SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet:SPAN <numeric>

SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet:SPAN?

Description

Sets the span value in the dc bias voltage sweep range. This command can be used when Option 001 (dc bias function) is installed.

In addition, use the **SOUR:VOLT:OFFS:CENT** command to set the center value of the sweep range.

Parameters

	<numeric>
Description	Span value in the sweep range
Data type	Floating point
Range	0 to 80
Default	0
Resolution	1E-3
Unit	V (volt)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:VOLT:OFFS:CENT command on page 481

Front Panel Equivalents

Stimulus - **Start/Stop...** - Span: V

SOUR:VOLT:OFFS:STAR

Format

SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STARt <numeric>

SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STARt?

Description

Sets the start value in the dc bias voltage sweep range. This command can be used when Option 001 (dc bias function) is installed.

In addition, use the **SOUR:VOLT:OFFS:STOP** command to set the stop value of the sweep range.

Parameters

	<numeric>
Description	Start value in the sweep range
Data type	Floating point
Range	-40 to 40
Default	0
Resolution	1E-3
Unit	V (volt)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:VOLT:OFFS:STOP command on page 485

Front Panel Equivalents

Stimulus - **Start/Stop...** - Start: V

SOUR:VOLT:OFFS:STAT

Format

SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STATe {ON|OFF|1|0}

SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STATe?

Description

Turns on/off the dc bias output in the voltage sweep mode or fixed voltage source mode. This command can be used when Option 001 (dc bias function) is installed.

Parameters

	Description
ON or 1	Turn on the dc bias output.*1
OFF or 0 (Default)	Turn off the dc bias output.

*1. When the dc bias output is converted from on to off, the sweep mode is automatically set to hold.

Query response

{1|0}<newline><^END>

Related commands

SOUR:CURR:OFFS:STAT command on page 465

Front Panel Equivalents

Stimulus - **Source...** - dc bias: [On/Off]

SOUR:VOLT:OFFS:STOP

Format

SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STOP <numeric>

SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STOP?

Description

Sets the stop value in the dc bias voltage sweep range. This command can be used when Option 001 (dc bias function) is installed.

In addition, use the **SOUR:VOLT:OFFS:STAR** command to set the start value in the sweep range.

Parameters

	<numeric>
Description	Stop value in the sweep range
Data type	Floating point
Range	-40 to 40
Default	0
Resolution	1E-3
Unit	V (volt)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:VOLT:OFFS:STAR command on page 483

Front Panel Equivalents

Stimulus - **Start/Stop...** - Stop: V

SOUR:VOLT:SPAN

Format

SOURce:VOLTage:SPAN <numeric>

SOURce:VOLTage:SPAN?

Description

Sets the span value in the oscillator voltage level sweep range.

In addition, use the **SOUR:VOLT:CENT** command to set the center value of the sweep range.

Parameters

	<numeric>
Description	Span value in the sweep range
Data type	Floating point
Range	0 to 497E-3
Default	200.0E-3
Resolution	1E-3
Unit	V (volt)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:VOLT:MODE command on page 479

SOUR:VOLT:CENT command on page 477

Front Panel Equivalents

Stimulus - **Start/Stop...** - Span: V

SOUR:VOLT:STAR

Format

SOURce:VOLTage:STARt <numeric>

SOURce:VOLTage:STARt?

Description

Sets the start value in the oscillator voltage level sweep range.

In addition, use the **SOUR:VOLT:STOP** command to set the stop value in the sweep range.

Parameters

	<numeric>
Description	Start value in the sweep range
Data type	Floating point
Range	5E-3 to 502E-3
Default	200E-3
Resolution	1E-3
Unit	V (volt)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:VOLT:MODE command on page 479

SOUR:VOLT:STOP command on page 488

Front Panel Equivalents

Stimulus - **Start/Stop...** - Start: V

SOUR:VOLT:STOP

Format

SOURce:VOLTage:STOP <numeric>

SOURce:VOLTage:STOP?

Description

Sets the stop value in the oscillator voltage level sweep range.

In addition, use the **SOUR:VOLT:STAR** command to set the start value in the sweep range.

Parameters

	<numeric>
Description	Stop value in the sweep range
Data type	Floating point
Range	5E-3 to 502E-3
Default	400E-3
Resolution	1E-3
Unit	V (volt)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SOUR:VOLT:MODE command on page 479

SOUR:VOLT:STAR command on page 487

Front Panel Equivalents

Stimulus - **Start/Stop...** - Stop: V

STAT:OPER?

Format — STATus:OPERation[:EVENt]?

Description — Returns the value of the Operation Status Event register. (Query only)

See Figure B-3, “Status Register Structure (1/2),” on page 561, for details of the status register structure.

See Table B-3, “Status Bit Definition of Operation Status Event Register,” on page 565 for the bit definition of the Operation Status Event register.

Query response — {numeric}<newline><^END>

Returns the integer value.

Related commands — ***CLS** command on page 279

Front Panel Equivalents — Unavailable.

STAT:OPER:COND?

Format — STATus:OPERation:CONDition?

Description — Returns the value of the Operation Status Condition register. (Query only)

See Figure B-3, “Status Register Structure (1/2),” on page 561, for details of the status register structure.

Query response — {numeric}<newline><^END>

Returns the integer value.

Front Panel Equivalents — Unavailable.

STAT:OPER:ENAB

Format

STATus:OPERation:ENABle <numeric>

STATus:OPERation:ENABle?

Description

Sets the value of the Operation Status Enable register.

See Figure B-3, “Status Register Structure (1/2),” on page 561, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the enable register
Data type	Integer
Range	0 to 32767
Default	0

When the parameter is not within the allowed configuration range, the parameter value will be set to the logical product (AND) of each bit from 32767 (0x7fff).

Query response

{numeric}<newline><^END>

Related commands

STAT:PRES command on page 493

STAT:OPER? command on page 489

Front Panel Equivalents

Unavailable.

STAT:OPER:NTR

Format

STATus:OPERation:NTRansition <numeric>

STATus:OPERation:NTRansition?

Description

Sets the value of the negative transition filter of the Operation Status register.

See Figure B-3, “Status Register Structure (1/2),” on page 561, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the negative transition filter
Data type	Integer
Range	0 to 32767
Default	0

When the parameter is not within the allowed configuration range, the parameter value will be set to the logical product (AND) of each bit from 32767 (0x7fff).

Query response

{numeric}<newline><^END>

Related commands

STAT:PRES command on page 493

STAT:OPER:PTR command on page 492

Front Panel Equivalents

Unavailable.

STAT:OPER:PTR

Format

STATus:OPERation:PTRansition <numeric>

STATus:OPERation:PTRansition?

Description

Sets the value of the positive transition filter of the Operation Status register.

See Figure B-3, “Status Register Structure (1/2),” on page 561, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the positive transition filter
Data type	Integer
Range	0 to 32767
Default	32767

When the parameter is not within the allowed configuration range, the parameter value will be set to the logical product (AND) of each bit from 32767 (0x7fff).

Query response

{numeric}<newline><^END>

Related commands

STAT:PRES command on page 493

STAT:OPER:NTR command on page 491

Front Panel Equivalents

Unavailable.

STAT:PRES

Format — STATus:PRESet

Description — Initializes the Operation Status and the Questionable Status. (No query)

Front Panel Equivalents — Unavailable.

STAT:QUES?

Format — STATus:QUEStionable[:EVENt]?

Description — Returns the value of the Questionable Status Event register. (Query only)

See Figure B-3, “Status Register Structure (1/2),” on page 561, for details of the status register structure.

See Table B-4, “Status Bit Definition of Questionable Status Event Register,” on page 565 for the bit definition of the Questionable Status Event register.

Query response — {numeric}<newline><^END>

Returns the integer value.

Related commands — ***CLS** command on page 279

Front Panel Equivalents — Unavailable.

STAT:QUES:COND?

Format — STATus:QUEStionable:CONDition?

Description — Returns the value of the Questionable Status Condition register. (Query only)

See Figure B-3, “Status Register Structure (1/2),” on page 561, for details of the status register structure.

Query response — {0}<newline><^END>

Returns the value of 0 for all query.

Front Panel Equivalents — Unavailable.

STAT:QUES:ENAB

Format

STATus:QUEStionable:ENABle <numeric>

STATus:QUEStionable:ENABle?

Description

Sets the value of the Questionable Status Enable register.

See Figure B-3, “Status Register Structure (1/2),” on page 561, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the enable register
Data type	Integer
Range	0 to 32767
Default	0

When the parameter is not within the allowed configuration range, the parameter value will be set to the logical product (AND) of each bit from 32767 (0x7fff).

Query response

{numeric}<newline><^END>

Related commands

STAT:PRES command on page 493

STAT:QUES? command on page 493

Front Panel Equivalents

Unavailable.

STAT:QUES:HARD?

Format — STATus:QUEStionable:HARDware[:EVENt]?

Description — Returns the value of the Questionable Status Hardware Event register. (Query only)

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

See Table B-5, “Status Bit Definition of Questionable Status Hardware Event Register,” on page 566 for the bit definition of the Questionable Status Hardware Event register.

Query response — {numeric}<newline><^END>

Returns the integer value.

Related commands — ***CLS** command on page 279

Front Panel Equivalents — Unavailable.

STAT:QUES:HARD:COND?

Format — STATus:QUEStionable:HARDware:CONDition?

Description — Returns the value of the Questionable Status Hardware Condition register. (Query only)

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

Query response — {0}<newline><^END>

Returns the value of 0 for all query.

Front Panel Equivalents — Unavailable.

STAT:QUES:HARD:ENAB

Format

STATus:QUEStionable:HARDware:ENABle <numeric>

STATus:QUEStionable:HARDware:ENABle?

Description

Sets the value of the Questionable Status Hardware Enable register.

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the enable register
Data type	Integer
Range	0 to 32767
Default	0

When the parameter is not within the allowed configuration range, the parameter value will be set to the logical product (AND) of each bit from 32767 (0x7fff).

Query response

{numeric}<newline><^END>

Related commands

STAT:PRES command on page 493

STAT:QUES:HARD? command on page 495

Front Panel Equivalents

Unavailable.

STAT:QUES:HARD:NTR

Format

STATus:QUEStionable:HARDware:NTRansition <numeric>

STATus:QUEStionable:HARDware:NTRansition?

Description

Sets the value of the negative transition filter of the Questionable Status Hardware register.

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the negative transition filter
Data type	Integer
Range	0 to 32767
Default	0

When the parameter is not within the allowed configuration range, the parameter value will be set to the logical product (AND) of each bit from 32767 (0x7fff).

Query response

{numeric}<newline><^END>

Related commands

STAT:PRES command on page 493

STAT:QUES:HARD:PTR command on page 498

Front Panel Equivalents

Unavailable.

STAT:QUES:HARD:PTR

Format

STATus:QUEStionable:HARDware:PTRansition <numeric>

STATus:QUEStionable:HARDware:PTRansition?

Description

Sets the value of the positive transition filter of the Questionable Status Hardware register.

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the positive transition filter
Data type	Integer
Range	0 to 32767
Default	32767

When the parameter is not within the allowed configuration range, the parameter value will be set to the logical product (AND) of each bit from 32767 (0x7fff).

Query response

{numeric}<newline><^END>

Related commands

STAT:PRES command on page 493

STAT:QUES:HARD:NTR command on page 497

Front Panel Equivalents

Unavailable.

STAT:QUES:LIM?

Format
STATus:QUEStionable:LIMit[:EVENt]?

Description
Returns the value of the Questionable Status Limit Event register. (Query only)

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

See Table B-6, “Status Bit Definition of Questionable Status Limit Event Register,” on page 566 for the bit definition of the Questionable Status Limit Event register.

Query response
{numeric}<newline><^END>

Returns the integer value.

Related commands
***CLS** command on page 279

Front Panel Equivalents
Unavailable.

STAT:QUES:LIM:COND?

Format
STATus:QUEStionable:LIMit:CONDition?

Description
Returns the value of the Questionable Status Limit Condition register. (Query only)

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

Query response
{0><^END>

Returns the value of 0 for all query.

Front Panel Equivalents
Unavailable.

STAT:QUES:LIM:ENAB

Format

STATus:QUEStionable:LIMit:ENABle <numeric>

STATus:QUEStionable:LIMit:ENABle?

Description

Sets the value of the Questionable Status Limit Enable register.

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the enable register
Data type	Integer
Range	0 to 32767
Default	0

When the parameter is not within the allowed configuration range, the parameter value will be set to the logical product (AND) of each bit from 32767 (0x7fff).

Query response

{numeric}<newline><^END>

Related commands

STAT:PRES command on page 493

STAT:QUES:LIM? command on page 499

Front Panel Equivalents

Unavailable.

STAT:QUES:LIM:NTR

Format

STATus:QUEStionable:LIMit:NTRansition <numeric>

STATus:QUEStionable:LIMit:NTRansition?

Description

Sets the value of the negative transition filter of the Questionable Status Limit register.

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the negative transition filter
Data type	Integer
Range	0 to 32767
Default	0

When the parameter is not within the allowed configuration range, the parameter value will be set to the logical product (AND) of each bit from 32767 (0x7fff).

Query response

{numeric}<newline><^END>

Related commands

STAT:PRES command on page 493

STAT:QUES:LIM:PTR command on page 502

Front Panel Equivalents

Unavailable.

STAT:QUES:LIM:PTR

Format

STATus:QUEStionable:LIMit:PTRansition <numeric>

STATus:QUEStionable:LIMit:PTRansition?

Description

Sets the value of the positive transition filter of the Questionable Status Limit register.

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the positive transition filter
Data type	Integer
Range	0 to 32767
Default	32767

When the parameter is not within the allowed configuration range, the parameter value will be set to the logical product (AND) of each bit from 32767 (0x7fff).

Query response

{numeric}<newline><^END>

Related commands

STAT:PRES command on page 493

STAT:QUES:LIM:NTR command on page 501

Front Panel Equivalents

Unavailable.

STAT:QUES:NTR

Format

STATus:QUEStionable:NTRansition <numeric>

STATus:QUEStionable:NTRansition?

Description

Sets the value of the negative transition filter of the Questionable Status register.

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the negative transition filter
Data type	Integer
Range	0 to 32767
Default	0

When the parameter is not within the allowed configuration range, the parameter value will be set to the logical product (AND) of each bit from 32767 (0x7fff).

Query response

{numeric}<newline><^END>

Related commands

STAT:PRES command on page 493

STAT:QUES:PTR command on page 504

Front Panel Equivalents

Unavailable.

STAT:QUES:PTR

Format

STATus:QUEStionable:PTRansition <numeric>

STATus:QUEStionable:PTRansition?

Description

Sets the value of the positive transition filter of the Questionable Status register.

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the positive transition filter
Data type	Integer
Range	0 to 32767
Default	32767

When the parameter is not within the allowed configuration range, the parameter value will be set to the logical product (AND) of each bit from 32767 (0x7fff).

Query response

{numeric}<newline><^END>

Related commands

STAT:PRES command on page 493

STAT:QUES:NTR command on page 503

Front Panel Equivalents

Unavailable.

STAT:QUES:SEAR?

Format

STATus:QUEStionable:SEARch[:EVENt]?

Description

Returns the value of the Questionable Status Search Event register. (Query only)

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

See Table B-7, “Status Bit Definition of Questionable Status Search Event Register,” on page 567 for the bit definition of the Questionable Status Search Event register.

Query response

{numeric}<newline><^END>

Returns the integer value.

Related commands

***CLS** command on page 279

Front Panel Equivalents

Unavailable.

STAT:QUES:SEAR:COND?

Format
STATus:QUEStionable:SEARch:CONDition?

Description
Returns the value of the Questionable Status Search Condition register. (Query only)

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

Query response
{0}<newline><^END>

Returns 0 for all query.

Front Panel Equivalents
Unavailable.

STAT:QUES:SEAR:ENAB

Format
STATus:QUEStionable:SEARch:ENABle <numeric>

STATus:QUEStionable:SEARch:ENABle?

Description
Sets the value of the Questionable Status Search Enable register.

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the enable register
Data type	Integer
Range	0 to 32767
Default	0

When the parameter is not within the allowed configuration range, the parameter value will be set to the logical product (AND) of each bit from 32767 (0x7fff).

Query response
{numeric}<newline><^END>

Related commands
STAT:PRES command on page 493

STAT:QUES:SEAR? command on page 504

Front Panel Equivalents
Unavailable.

STAT:QUES:SEAR:NTR

Format

STATus:QUEStionable:SEARch:NTRansition <numeric>

STATus:QUEStionable:SEARch:NTRansition?

Description

Sets the value of the negative transition filter of the Questionable Status Search register.

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the negative transition filter
Data type	Integer
Range	0 to 32767
Default	0

When the parameter is not within the allowed configuration range, the parameter value will be set to the logical product (AND) of each bit from 32767 (0x7fff).

Query response

{numeric}<newline><^END>

Related commands

STAT:PRES command on page 493

STAT:QUES:SEAR:PTR command on page 507

Front Panel Equivalents

Unavailable.

STAT:QUES:SEAR:PTR

Format

STATus:QUEStionable:SEARch:PTRansition <numeric>

STATus:QUEStionable:SEARch:PTRansition?

Description

Sets the value of the positive transition filter of the Questionable Status Search register.

See Figure B-4, “Status Register Structure (2/2),” on page 562, for details of the status register structure.

Parameters

	<numeric>
Description	Value of the positive transition filter
Data type	Integer
Range	0 to 32767
Default	32767

When the parameter is not within the allowed configuration range, the parameter value will be set to the logical product (AND) of each bit from 32767 (0x7fff).

Query response

{numeric}<newline><^END>

Related commands

STAT:PRES command on page 493

STAT:QUES:SEAR:NTR command on page 506

Front Panel Equivalents

Unavailable.

SWE:DIR

Format

[SENSe:]SWEep:DIRection {UP|DOWN}

[SENSe:]SWEep:DIRection?

Description

Selects the direction of the sweep.

Parameters

	Description
UP (Default)	Specifies the direction toward the increasing stimulus value.
DOWN	Specifies the direction toward the decreasing stimulus value.

Query response

{UP|DOWN}<newline><^END>

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Sweep Direction: [Up/Down]

SWE:DWEL1

Format

[SENSe:]SWEep:DWELl1 <numeric>

[SENSe:]SWEep:DWELl1?

Description

Sets the delay time for each sweep.In addition, when automatic sweep time is set to auto with the **SWE:TIME:AUTO** command, the delay time is reset to 0 second.

Parameters

	<numeric>
Description	Delay time
Data type	Floating point
Range	0 to 20
Default	0
Resolution	1E-4
Unit	s (seconds)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SWE:TIME:AUTO command on page 514

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Sweep Time: [Auto/Manual] - Sweep Delay

SWE:DWEL2

Format

[SENSe:]SWEep:DWELl2 <numeric>

[SENSe:]SWEep:DWELl2?

Description

Sets the delay time for each measurement point. In addition, when automatic sweep time is set to auto with the **SWE:TIME:AUTO** command, the delay time is reset to 0 second.

Parameters

	<numeric>
Description	Delay time
Data type	Floating point
Range	0 to 20
Default	0
Resolution	1E-4
Unit	s (seconds)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SWE:TIME:AUTO command on page 514

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Sweep Time: [Auto/Manual] - Point Delay

SWE:DWEL3

Format

[SENSe:]SWEep:DWELl3 <numeric>

[SENSe:]SWEep:DWELl3?

Description

Sets the delay time for each segment in the segment sweep mode. In addition, when automatic sweep time is set to auto with the **SWE:TIME:AUTO** command, the delay time is reset to 0 second.

Parameters

	<numeric>
Description	Delay time
Data type	Floating point
Range	0 to 20
Default	0
Resolution	1E-4
Unit	s (seconds)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SWE:TIME:AUTO command on page 514

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Sweep Time: [Auto/Manual] - Segment Delay

SWE:POIN

Format

[SENSe:]SWEep:POINts <numeric>

[SENSe:]SWEep:POINts?

Description

Sets the number of points measured at each sweep.

Parameters

	<numeric>
Description	Number of points
Data type	Integer
Range	2 to 801
Default	201

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Number Of Points

SWE:STIM{1-4}?

Format [SENSe:]SWEep:STIMulus{1-4}?

Description Reads the stimulus value at all measurement points. (Query only)

Parameters

Sub-block	Description
STIMulus1	Specifies the stimulus value at the frequency sweep.
STIMulus2	Specifies the stimulus value at the oscillator level sweep.
STIMulus3*1	Specifies the stimulus value at the dc bias voltage sweep.
STIMulus4*1	Specifies the stimulus value at the dc bias current sweep.

*1. This can be used when Option 001 (dc bias function) is installed.

Query response {numeric 1}, {numeric 2},.., {numeric N-1}, {numeric N}<newline><^END>

Where N is the number of measurement points.

Floating point type numeric is sensed.

Related commands **FORM:DATA** command on page 374

Front Panel Equivalents Unavailable.

SWE:TIME

Format

[SENSe:]SWEep:TIME <numeric>

[SENSe:]SWEep:TIME?

Description

Sets the sweep time.

Parameters

	<numeric>
Description	Sweep time
Data type	Floating point
Range	0 to approximately. (Nop × 20)
Default	1.45
Resolution	1E-4
Unit	s (seconds)

If the specified parameter is outside the range, the minimum (if the lower limit of the range is exceeded) or maximum value (if the upper limit is exceeded) will be assumed.

Query response

{numeric}<newline><^END>

Related commands

SWE:TIME:AUTO command on page 514

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Sweep Time: [Auto/Manual] - Sweep Time

SWE:TIME:AUTO

Format

[SENSe:]SWEep:TIME:AUTO {ON|OFF|1|0}

[SENSe:]SWEep:TIME:AUTO?

Description

Selects the automatic sweep time either by auto setting or by manual setting.

Parameters

	Description
ON or 1 (Default)	Specifies the auto setting*1.
OFF or 0	Specifies the manual setting*2.

*1. The shortest sweep time is set of the present setting of E4991A.
*2. By using the **SWE:TIME** command, sets the sweep time.

Query response

{1|0}<newline><^END>

Related commands

SWE:TIME command on page 513

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Sweep Time: [Auto/Manual]

SWE:TYPE

Format

[SENSe:]SWEep:TYPE {LINear|LOGarithmic|SEGMent|POWer|DCV|DCI}

[SENSe:]SWEep:TYPE?

Description

Selects the sweep parameter (sweep type).

Parameters

	Description
LINear (Default)	Specifies the frequency sweep (linear sweep).
LOGaritmic	Specifies the frequency sweep (log sweep).
SEGMent*1	Specifies the frequency sweep (segment sweep).
POWer	Specifies the oscillator level sweep (linear sweep).
DCV*2	Specifies the dc bias voltage sweep (linear sweep).
DCI*2	Specifies the dc bias current sweep (linear sweep).

*1. In order to set the segment sweep, it is necessary to create the segment sweep table in advance.
*2. This can be used when Option 001 (dc bias function) is installed.

Query response

{LIN|LOG|SEGM|POW|DCV|DCI}<newline><^END>

Front Panel Equivalents

Stimulus - **Sweep Setup...** - Sweep Parameter|Sweep Type

SYST:BEEP

Format
SYSTem:BEEPer[:IMMediate]

Description
Produces a beep sound. (No query)

Front Panel Equivalents
Unavailable.

SYST:BEEP:STAT

Format
SYSTem:BEEPer:STATe {ON|OFF|1|0}

SYSTem:BEEPer:STATe?

Description
Turns on/off the beep output.

Parameters

	Description
ON or 1 (Default)	Enables the beep sound.
OFF or 0	Disables the beep sound.

Query response
{1|0}<newline><^END>

Front Panel Equivalents
System - **System...** - Beep: [On/Off]

SYST:DATE

Format

SYSTem:DATE <numeric 1>,<numeric 2>,<numeric 3>

SYSTem:DATE?

Description

Sets date.

Parameters

	<numeric 1>	<numeric 2>	<numeric 3>
Description	year	month	day
Data type	Integer	Integer	Integer
Range	1980 to 2099	1 to 12	1 to 31

When the specified parameter is not within the valid configuration range, an error will occur and the command will be ignored.

Query response

{numeric 1},{numeric 2},{numeric 3}<newline><^END>

Related commands

SYST:TIME on page 524

Front Panel Equivalents

see *Operation Manual*.

SYST:ERR?

Format

SYSTem:ERRor?

Description

Returns the oldest error stored in the error cue. When the ***CLS** command is executed, errors stored in the error cue are cleared. (Query only)

Query response

{numeric},{string}<newline><^END>

	<numeric>	<string>
Description	error number	error message (string character with double quotation)
Data type	Integer	none

Related commands

SYST:ERR:COUN? command on page 518

***CLS** command on page 279

Front Panel Equivalents

Unavailable.

SYST:ERR:COUN?

Format — SYSTem:ERRor:COUNt?

Description — Returns number of errors stored in the error cue. (Query only)

Query response — {numeric}<newline><^END>

Returns the integer value.

Related commands — **SYST:ERR?** command on page 517

Front Panel Equivalents — Unavailable.

SYST:EXTR?

Format — SYSTem:EXTRef?

Description — Returns whether an external reference signal is being received from the external reference signal input connector located in the rear panel. (Query only)

Query response — {1|0}<newline><^END>

	Description
1	External reference signal is being received.
0	External reference signal is not being received.

Front Panel Equivalents — Unavailable.

SYST:IND:POIN:SET

Format

SYSTem:INDex:POINt:SET

SYSTem:INDex:POINt:SET?

Description

Sets the timing of the measurement index signal for every measurement point.

Query response

{1|0}<newline><^END>

	Description
1	The timing of the measurement index signal for every measurement is being selected.
0 (Default)	The timing of the measurement index signal for every measurement is not being selected.

Related commands

SYST:IND:SWE:SET command on page 519

SYST:IND:TIME:SET command on page 521

Front Panel Equivalents

System - **Diagnostic** - **Properties...** - At Point

SYST:IND:SWE:SET

Format

SYSTem:INDex:SWEep:SET

SYSTem:INDex:SWEep:SET?

Description

Sets the timing of the measurement index signal for every sweep.

Query response

{1|0}<newline><^END>

	Description
1	The timing of the measurement index signal for every sweep is being selected.
0 (Default)	The timing of the measurement index signal for every sweep is not being selected.

Related commands

SYST:IND:POIN:SET command on page 519

SYST:IND:TIME:SET command on page 521

Front Panel Equivalents

System - **Diagnostic** - **Properties...** - At Only Sweep End

SYST:IND:TIME

Format

SYSTem:INDex:TIME <numeric>

SYSTem:INDex:TIME?

Description

Sets the amount of time between internal measurement and trace display when setting the timing of the measurement index signal.

Parameters

	<numeric>
Description	Timing of the measurement index signal
Data type	Floating point
Range	0.001 to 5
Default	0.3
Resolution	0.001
Unit	s (seconds)

Query response

{numeric}<newline><^END>

Related commands

SYST:IND:TIME:SET command on page 521

Front Panel Equivalents

System - **Diagnostic** - **Properties...** - Timer Index Interval Time

SYST:IND:TIME:SET

Format

SYSTem:INDex:TIME:SET

SYSTem:INDex:TIME:SET?

Description

Allows the user to set the amount of time between internal measurement and trace display when setting the timing of the measurement index signal.

Query response

{1|0}<newline><^END>

	Description
1(Default)	The timing of the measurement index signal is being selected.
0	The timing of the measurement index signal is not being selected.

Related commands

SYST:IND:TIME command on page 520

SYST:IND:POIN:SET command on page 519

SYST:IND:SWE:SET command on page 519

Front Panel Equivalents

System - **Diagnostic** - **Properties...** - At Time

SYST:KLOC

Format

SYSTem:KLOCk[:FPANel] {ON|OFF|1|0}

SYSTem:KLOCk[:FPANel]?

Description

Specifies whether to lock the front panel key, rotary knob, and the keyboard.

The specifications of this command are identical to the SYST:KLOC:KBD command.

Parameters

	Description
ON or 1	Front panel keys and rotary knob locked
OFF or 0 (Default)	Front panel keys and rotary knob unlocked

Query response

{1|0}<newline><^END>

Related commands

SYST:KLOC:KBD command on page 522

SYST:KLOC:MOUS command on page 523

Front Panel Equivalents

Unavailable.

SYST:KLOC:KBD

Format

SYSTem:KLOCk:KBD {ON|OFF|1|0}

SYSTem:KLOCk:KBD?

Description

Specifies whether to lock the front panel keys, rotary knob, and the keyboard.

The specifications of this command are identical to the SYST:KLOC command.

Parameters

	Description
ON or 1	Keyboard locked
OFF or 0 (Default)	Keyboard unlocked

Query response

{1|0}<newline><^END>

Related commands

SYST:KLOC command on page 522

SYST:KLOC:MOUS command on page 523

Front Panel Equivalents

Unavailable.

SYST:KLOC:MOUS

Format
SYSTem:KLOCk:MOUSe {ON|OFF|1|0}
SYSTem:KLOCk:MOUSe?

Description
Specifies whether to lock the mouse.

Parameters

	Description
ON or 1	Mouse locked
OFF or 0 (Default)	Mouse unlocked

Query response
{1|0}<newline><^END>

Related commands
SYST:KLOC command on page 522
SYST:KLOC:KBD command on page 522

Front Panel Equivalents
Unavailable.

SYST:POFF

Format
SYSTem:POFF

Description
Turns E4991A's main power off. (No query)

Front Panel Equivalents
Standby switch.

SYST:PRES

Format
SYSTem:PRESet

Description
Resets the E4991A to its initial settings. Resetting the E4991A by using the ***RST** command provides basically the same function except for the points below.

- Continuous initialization of the trigger system is set to ON.
- Settings of data transfer format are not changed.

Related commands
***RST** command on page 282

Front Panel Equivalents
[Preset] key

SYST:TIME

Format

SYSTem:TIME <numeric 1>,<numeric 2>,<numeric 3>

SYSTem:TIME?

Description

Sets time of internal clock.

Parameters

	<numeric 1>	<numeric 2>	<numeric 3>
Description	hour (24 hour format)	minute	second
Data type	Integer	Integer	Integer
Range	0 to 23	0 to 59	0 to 59

When the specified parameter is not within the valid configuration range, an error will occur and the command will be ignored.

Query response

{numeric 1},{numeric 2},{numeric 3}<newline><^END>

Related commands

SYST:DATE on page 517

Front Panel Equivalents

see *Operation Manual*.

SYST:VERS?

Format

SYSTem:VERSion?

Description

Returns the SCPI compliant version. (Query only)

Query response

{string}<newline><^END>

The returned string characters are formatted as “1997.0”. 1997 in the format represents the release year of the version, and 0 represents the version number of that year.

Front Panel Equivalents

Unavailable.

TRIG

Format

TRIGger[:SEQuence][:IMMediate]

Description

The trigger system immediately triggers and executes measurements during the trigger event detection state. An error will occur if the trigger sequence is not in the trigger event detection state. (No query)

Front Panel Equivalents

Unavailable.

TRIG:EVEN

Format

TRIGger[:SEQuence]:EVENt[:TYPe] {SWEep|POINt|SEGMent}

TRIGger[:SEQuence]:EVENt[:TYPe]?

Description

Selects the detection point of trigger events.

Parameters

	Description
SWEep*1 (Default)	When a trigger event is detected, a sweep is executed once.
POINt	When a trigger event is detected, measurements are carried out at each measurement point. Therefore, detection of trigger events must be executed as many times as the number of measurement points before a sweep is completed.
SEGMent	When a trigger event is detected during a segment sweep, the sweep is executed according to the sweep setting of the segment. Therefore, the number of detected trigger events must equal the number of segments before a sweep is completed for all of the segments of the list sweep table.

*1. When Internal Trigger is selected, SWEep is selected automatically.

Query response

{SWE|POIN|SEGM}<newline><^END>

Related commands

TRIG:SOUR on page 526

Front Panel Equivalents

Trigger - **Trigger Setup...** - **Trigger Event**

TRIG:SLOP

Format

TRIGger[:SEQuence]:SLOPe {POSitive|NEGative}

TRIGger[:SEQuence]:SLOPe?

Description

Selects the polarity of the trigger signal that is to be received by the external trigger input connector, located on the rear panel. When set to positive, a trigger is executed when the signal changes from a low level to a high level. When set to negative, a trigger is executed by the opposite signal level change direction.

Parameters

	Description
POSitive (Default)	Specifies positive (trigger is executed when the signal changes from a low level to a high level).
NEGative	Specifies negative (trigger is executed when the signal changes from a high level to a low level).

Query response

{POS|NEG}<newline><^END>

Front Panel Equivalents

Trigger - **Trigger Setup...** - Trigger Polarity: [Negative/Positive]

TRIG:SOUR

Format

TRIGger[:SEQuence]:SOURce {INTernal|MANual|EXTernal|BUS}

TRIGger[:SEQuence]:SOURce?

Description

Selects the trigger source.

Parameters

	Description
INTernal (Default)	Specifies an internal trigger.
MANual	Specifies a manual trigger (operated by the front panel key).
EXTernal	Specifies an external trigger (received by the EXT TRIGGER connector on the rear panel).
BUS	Specifies the GPIB trigger (trigger operated by execution of ***TRG** command).

Query response

{INT|MAN|EXT|BUS}<newline><^END>

Front Panel Equivalents

Trigger - **Trigger Setup...** - **Trigger Source**

18 COM Interface Reference

This chapter gives COM interface references of the Agilent E4991A classified according to object.

Conventions of COM Interface

Explanation

The section titled “Explanation” describes the method of controlling the E4991A with the COM interface.

VB Syntax

The section titled “VB Syntax” describes the format to use for writing programs in Visual Basic.

Parameter

The section titled “Parameter” describes the parameters required for the methods of COM object.

Data types

Generally, the following data types can be used for the variables of an argument in COM object. The data type of each variable can be declared before using the variable. If the data type of a variable is not declared, it automatically becomes variant.

Data type	Name	Memory requirement	Range
Integer	Integer type	2 bytes	-32768 to 32767
Long	Long integer type	4 bytes	-2147483648 to 2147483647
Single	Single precision floating-point type	4 bytes	• In the case of negative value -3.402823E38 to -1.401298E-45 • In the case of positive value 1.401298E-45 to 3.402823E38
Double	Double precision floating-point type	8 bytes	• In the case of negative value -1.79769313486232E308 to -4.94065645841247E-324 • In the case of positive value -1.79769313486232E308 to -4.94065645841247E-324
Boolean	Boolean type	2 bytes	1 (True) or 0 (false)

Data type	Name	Memory requirement	Range
String (BSTR)	String type	1 byte/character (alphanumeric)	• Fixed-length character Declaration of the number of characters is required. • Variable-length character Maximum of about 64,000 characters
Object	Object type	4 bytes	Browsing object of choice
Variant	Variant type	16 bytes	No limitation

Response

The section titled “Response” describes the format of data to be read when the “Read” function (reading data) of COM object is possible.

Examples

The section titled “Examples” gives examples of programming using Visual Basic.

Application object

This section explains Application object.

Name property

Explanation Reads application name (Read only).

VB syntax Application.Name

or

Name

Response Reading in string type. Always “E4991A”.

Examples The following is a program example of reading the application name and displaying it in the message box.

Example 18-1 **Example of using Name property**

```
Dim Name As String
Name = Application.Name
MsgBox "Application Name : " & Name
```

VBAVersion property

Explanation Reads the version of the E4991AVBA. (Read only)

VB syntax Application.VBAVersion

or

VBAVersion

Response Reading in string type.

Examples The following is a program example of reading the version of the E4991A VBA and displaying it in the message box.

Example 18-2 **Example of using VBAVersion property**

```
Dim Version As String
Version = Application.VBAVersion
MsgBox "VBA Version : " & Version
```

Connection property

Explanation

Reads whether a personal computer is connected to the E4991A by using the E4991A remote user interface function. When this COM object is executed by the installed E4991A VBA, it will always read 1. (Read only)

VB syntax

Application.Connection

or

Connection

Response

Value of long integer type (1 or 0) is sent back.

1	Connected to the E4991A
0	Not connected to the E4991A

Examples

The following is a program example of checking whether the E4991A is accessible from a personal computer.

Example 18-3 **Example of using Connection property**

```
Dim Connection As Long
Connection = Application.Connection
If Connection = 1 Then
  MsgBox "Remote U/I function is available."
ElseIf Connection = 0 Then
  MsgBox "Remote U/I function is not available."
End If
```

SingleMeasure method

Explanation

Executes sweep under current setting once and waits for the completion of the sweep. If sweep averaging is enabled, sweep is performed the same number of times as that of the sweep averaging factor. This method sends a response back.

VB syntax

Application.SingleMeasure

or

SingleMeasure

Response

Value of long integer type (1 or 0) is sent back.

1	Sweep was completed.
0	Sweep was interrupted.

Examples

The following is a program example of performing the sweep once after the DUT is connected and then giving notification of the completion of the sweep.

Example 18-4 **Example of using SingleMeasure method**

```
Dim Bool As Long
MsgBox "Connect DUT to Test Fixture"
Bool = Application.SingleMeasure
If Bool = 1 Then
  MsgBox "Sweep Done!"
ElseIf Bool = 0 Then
  MsgBox "Sweep Aborted!"
End If
```

CalMeasure method

Explanation

Measures calibration data (Open/Short/Load/Low-loss capacitor) and waits for the completion of measurement. This method sends a response back.

VB syntax

Application.CalMeasure(CalType)

or

CalMeasure(CalType)

Parameter

CalType: To be selected from the following.

CalOpen	Specifies measurement of Open calibration data
CalShort	Specifies measurement of Short calibration data
CalLoad	Specifies measurement of Load calibration data
CalLowLossC	Specifies measurement of Low-loss capacitor calibration data

Response

Value of long integer type (1 or 0) is sent back.

1	Measurement of each standard's calibration data was completed.
0	Measurement was interrupted.

Examples

The following is a program example of indicating the completion of measurement after connecting the open standard of the calibration kit to the 7-mm terminal and measuring the calibration data.

Example 18-5 **Example of using CalMeasure method**

```
Dim Bool As Long
MsgBox "Connect OPEN Standard to 7mm Terminal"
Bool = Application.CalMeasure(CalOpen)
If Bool = 1 Then
  MsgBox "OPEN Calibration Done!"
ElseIf Bool = 0 Then
  MsgBox "OPEN Calibration Aborted!"
End If
```

CompenMeasure method

Explanation

Measures fixture compensation data (Open/Short) and waits for the completion of measurement. This method sends a response back.

VB syntax

Application.CompenMeasure(CompenType)

or

CompenMeasure(CompenType)

Parameter

CompenType: To be select from the following.

CompenOpen	Specifies measurement of Open compensation data.
CompenShort	Specifies measurement of Short compensation data.

Response

Value of long integer type (1 or 0) is sent back.

1	Measurement was completed.
0	Measurement was interrupted.

Examples

The following is a program example of indicating the completion of measurement after connecting the open standard of the fixture compensation kit to the test fixture and performing the measurement.

Example 18-6 **Example of using CompenMeasure method**

```
Dim Bool As Long
MsgBox "Connect OPEN Compen Standard to Test Fixture"
Bool = Application.CompenMeasure(CompenOpen)
If Bool = 1 Then
  MsgBox "OPEN Compensation Done!"
ElseIf Bool = 0 Then
  MsgBox "OPEN Compensation Aborted!"
End If
```

GetTextData method

Explanation Copies main setting parameters or measurement data of the E4991A to the clipboard in CSV format in order to paste them into an application like Microsoft Word or Microsoft Excel. This method can be performed by a personal computer that uses the E4991A remote user interface function.

VB syntax Application.GetTextData(DataName)

or

GetTextData(DataName)

Parameter DataName: To be selected from the following.

OperatingParameters	Specifies setting parameters of the E4991A.
ListValues	Specifies measurement data.

Examples The following is a program example of copying measurement data onto the clipboard in CSV format.

Example 18-7 **Example of using GetTextData method**

```
Application.GetTextData (ListValues)
```

GetScreenImage method

Explanation Copies the screen image to the clipboard in the specified file format in order to paste it into an application like Microsoft Word or Microsoft Excel. This method can be performed by a personal computer that uses the E4991A remote user interface function.

VB syntax Application.GetScreenImage (ImageForm)

or

GetScreenImage (ImageForm)

Parameter ImageForm: To be selected from the following.

BMP	Specifies the bitmap format.
JPG	Specifies the JPEG format.

Examples The following is a program example of copying the screen display to the clipboard in the bitmap format.

Example 18-8 **Example of usingGetScreenImage method**

```
Application.GetScreenImage (BMP)
```

WaitForEvent method

Explanation

Waits for the occurrence of a specified event for the specified period of time. This method sends a response back.

VB syntax

Application.WaitForEvent(EventName, MaxTime)

or

WaitForEvent(EventName, MaxTime)

Parameter

EventName: To be selected from the following events.

SweepEnd	Specifies the completion of sweep.
SweepStart	Specifies the start of sweep.
CompleteSweepAveraging	Specifies the completion of specified number of sweep averaging.
WaitForTrigger	Specifies the status of waiting for trigger

MaxTime: Specifies maximum time to wait for occurrence of the event

Value type	Long integer type
Range	0 to 1E6
Unit	s (seconds)

Response

Value of long integer type (1 or 0) is sent back.

1	Specified event was received within specified time.
0	Specified event was not received within specified time and it resulted in time-out.

Examples

The following is an example of displaying a message when the trigger-waiting status does not occur 10 seconds after confirming that the trigger system is in trigger waiting status.

Example 18-9 **Example of using WaitForEvent method**

```
Dim Bool As Long
Bool = Application.WaitForEvent(WaitForTrigger, 10)
If Bool = 0 Then
  MsgBox "Time Out occured"
End If
```

SweepEnd event

Explanation Indicates specified sweep (measurement) is completed.

Parameter SweepMode: To be selected from the following.

Measure	Specifies sweep
Calibration	Specifies measurement of calibration data
Compensation	Specifies measurement of fixture compensation data

Examples The following is an example of displaying a message when measurement of calibration data is completed. The following program has to be described in user form or class module.

Example 18-10 **Example of using SweepEnd event**

```
Public WithEvents Evnt As E4991ALib.ApplicationPublic WithEvents
Evnt As E4991ALib.Application

Private Sub Evnt_SweepEnd(ByVal Mode As SweepMode)
  If Mode = Measure Then
    MsgBox "A measurement is completed."
  ElseIf Mode = Calibration Then
    MsgBox "A measurement of calibration data is completed."
  ElseIf Mode = Compensation Then
    MsgBox "A measurement of compensation data is completed."
  End If
End Sub
```

SweepStart event

Explanation Indicates specified sweep (measurement) has started.

Parameter SweepMode: To be selected from the following.

Measure	Specifies sweep
Calibration	Specifies measurement of calibration data
Compensation	Specifies measurement of fixture compensation data

Examples The following is an example of loading and showing a user form (Abort_yn) on the screen when the measurement of calibration data or fixture compensation data has started (the program code of Abort_yn is not included in this sample). The following program has to be described in user form or class module.

Example 18-11 **Example of using SweepStart event**

```
Public WithEvents Evnt As E4991ALib.Application

Private Sub Evnt_SweepStart(ByVal Mode As SweepMode)
  If Mode = Calibration Or Compensation Then
    Load Abort_yn
    Abort_yn.Show
  End If
End Sub
```

CompleteSweepAveraging event

Explanation Indicates specified number of sweep averaging is completed when the sweep averaging function is used.

Examples The following is an example of producing a beep sound when the specified number of sweep averaging is completed. The following program has to be described in user form or class module.

Example 18-12 **Example of using CompleteSweepAveraging event**

```
Public WithEvents Evnt As E4991ALib.Application

Private Sub Evnt_CompleteSweepAveraging()
  Application.SCPI.Output "SYST:BEEP"
End Sub
```

Unlocked event

Explanation Indicates that “PLL Unlock” error was detected in the E4991A.

Examples The following is an example of stopping a program by force when a “PLL Unlock” error occurs during measurement. The following program has to be described in user form or class module.

Example 18-13 **Example of using Unlocked event**

```
Public WithEvents Evnt As E4991ALib.Application

Private Sub Evnt_Unlocked()
  MsgBox "Error: PLL Unlock"
  End
End Sub
```

DcBiasOverload event

Explanation Indicates that “DC bias overload” error was detected in the E4991A.

Examples The following is an example of stopping a program by force when a “DC bias overload” error occurs during measurement. The following program has to be described in user form or class module.

Example 18-14 **Example of using DcBiasOverload event**

```
Public WithEvents Evnt As E4991ALib.Application

Private Sub Evnt_DcBiasOverload()
  MsgBox "Error: Dc bias overload"
  End
End Sub
```

RfOverload event

Explanation Indicates that “RF overload” error was detected in the E4991A.

Examples The following is an example of stopping a program by force when the “RF overload” error occurs during measurement. The following program has to be described in user form or class module.

Example 18-15 **Example of using RfOverload event**

```
Public WithEvents Evnt As E4991ALib.Application

Private Sub Evnt_RfOverload()
  MsgBox "Error: RF overload"
  End
End Sub
```

SCPI object

This section explains details of the SCPI object.

Name property

Explanation Reads object name "SCPI" (Read only)

VB syntax Application.SCPI.Name

or

SCPI.Name

Response Reading in string type. Always "SCPI".

Examples The following is a program example of reading the object name and displaying it in the message box.

Example 18-16 **Example of using Name property**

```
Dim Name As String
Name = Application.SCPI.Name
MsgBox "Object Name : " & Name
```

Enter method

Explanation

Reads the returned value of an E4991A GPIB command executed by Query using the Output method.

VB syntax

Application.SCPI.Enter(Res,[fmt])

or

SCPI.Enter(Res,[fmt])

Parameter

fmt: Specifies option parameters.

The method of reading data can be specified by the following option parameters.

#	Receives data divided by comma (,).
*	Skips data and clears one data item in the queue.

These option parameters can be used in combination, and also it is not necessary to specify one. For details on using option parameters, refer to “How to read array data” on page 544.

Response

Res: Sends back the response to Query command.

Data type should be specified as variant. When specifying a data type other than variant, refer to the description of Query response of applicable GPIB commands in Chapter 17, “GPIB Command Reference,” on page 275.

Examples

The following is a program example of using the **Enter method**.

Example 18-17 **Example of using Enter method**

```
Dim Trace_data As Variant
Application.SingleMeasure
Application.SCPI.Output "FORM:DATA ASC"
Application.SCPI.Output "CALC1:DATA? FDATA"
Application.SCPI.Enter Trace_data, "#"
```

Output method

Explanation Executes a GPIB command of the E4991A.

VB syntax Application.SCPI.Output(Cmd)

or

SCPI.Output(Cmd)

Parameter Cmd: Specifies GPIB command by enclosing it within double quotation marks (“”) in the form of a string.

Examples The following is a program example of using the **Output method**.

Example 18-18 **Example of using Output method**

```
Application.SCPI.Output "DISP:TRAC1 ON"
Application.SCPI.Output "DISP:TRAC1:TITL:DATA ""Test Data"" "
Application.SCPI.Output "DISP:TRAC1:TITL ON"
```

Query method

Explanation Executes a GPIB command of the E4991A by Query and receives its response.

VB syntax Application.SCPI.Query(Cmd)

or

SCPI.Query(Cmd)

Parameter Cmd: Specifies GPIB command with “?” by enclosing it within double quotation marks (“”) in string form.

Response Response to Query command is sent back.

Data type should be specified as variant. When specifying a data type other than variant, refer to the description of Query response of applicable GPIB commands in Chapter 17, “GPIB Command Reference,” on page 275.

Examples The following is a program example of using the **Query method**.

Example 18-19 **Example of using Query method**

```
Dim Cw_freq As Double
Cw_freq = Application.SCPI.Query("FREQ?")
MsgBox "CW Frequency : " & Cw_freq & "Hz"
```

How to read array data

In the case of using the **Output method** to send GPIB commands with “?”, the returned values are built up in the queue provided in the E4991A main body. The **Enter method** is the object used to read data from that queue. If the data is a single data item that is not divided with commas (,), it can be read as is. In the case of data divided with commas (,), the required data can be read in the required form by specifying the following option parameters in the **Enter method**.

NOTE Binary formatted array data cannot be read by the **Enter method**. It is necessary to set the transfer format for reading array data to the ASCII format by using **FORM:DATA** on page 374 before using the **Enter method**.

Option parameters offered in Enter method

The following option parameters can be specified in the **Enter method** as required.

#	Receives data by dividing data with comma (,).
*	Skips a data item in the queue.

Not specifying option parameter

When the **Enter method** is executed without specifying option parameters, the part of data to be read differs depending on the data type of the variable used in reading data. However, the contents of the queue become empty regardless of the data type.

- When the data type is numeric:

Example 18-20 No specification of option parameters

Assume there are returned values ("1,2,3,4") of "SCPI.Output "DATA:RAW?" kept in the queue.

```
Dim Val as Double
SCPI.Output "DATA:RAW?"
SCPI.Enter Val
```

If "SCPI.Enter Val" is executed here, the first data only is read and substituted into Val (Val=1). The rest of the data is cancelled at this point, and the queue becomes empty.

- When the data type is string:

Example 18-21 **No specification of option parameters**

Assume there are returned values ("Agilent, E4991A, 113,1.0") from "SCPI.Output "*IDN?" kept in the queue.

```
Dim Val as String
SCPI.Output "*IDN?"
SCPI.Enter Val
```

If "SCPI.Enter Val" is executed here, the entire data is read as one string and substituted into Val (Val = "Agilent, E4991A, 113,1.0"). At this point, the queue becomes empty.

- When the data type is variant:

Example 18-22 **No specification of option parameters**

Assume there are returned values ("1,2,3,4") of "SCPI.Output "DATA:RAW?" kept in the queue.

```
Dim Val as Variant
SCPI.Output "DATA:RAW?"
SCPI.Enter Val
```

If "SCPI.Enter Val" is executed here, the entire data is read as one string and substituted into Val (Val = "1,2,3,4"). At this point, the queue becomes empty.

Specifying option parameters

When the **Enter method** is executed while specifying option parameters, it becomes possible to read the data divided with commas (,) in the required form.

Aim: Reading the “n”th data

- When the data type is numeric:

Example 18-23 **Specifying option parameters “*” and “#”**

Assume there are returned values ("1,2,3,4") of "SCPI.Output "DATA:RAW?" kept in the queue. The method to read the 3rd data item and empty the queue is as follows.

```
Dim Val as Double
SCPI.Output "DATA:RAW?"
SCPI.Enter Val, "#"
SCPI.Enter Val, "*,#"
SCPI.Enter Val
```

When "SCPI.Enter Val "#" is executed, the first data item only is read and substituted into Val (Val = 1). At this point, the 2nd data onward (2, 3, 4) still remain in the queue.

When "SCPI.Enter Val. "*, #" is executed after that, the first data item in the queue is not read but skipped due to the specification of option parameter "*". Therefore, Val = 1 still remains at this point. Also, the 3rd data onward (3, 4) still remain in the queue.

When "SCPI.Enter Val" is executed for the final time, the first data item in the queue is read and substituted into Val (Val = 3). The queue becomes empty because no option parameter "#" is specified at this point.

- When the data type is string:

Example 18-24 **Specifying option parameters “*” and “#”**

Assume there are returned values ("Agilent, E4991A, 113,1.0") from "SCPI.Output "*IDN?" kept in the queue. The method used to read the 2nd data item ("E4991A") divided with commas (,) and empty the queue is as follows.

```
Dim Val as String
SCPI.Output "*IDN?"
SCPI.Enter Val, "#"
SCPI.Enter Val, "#"
SCPI.Enter Val, "*"
```

When "SCPI.Enter Val, "#" is executed, the first data item only is read and substituted into Val (Val = "Agilent"). At this point, the 2nd data onward ("E4991A, 113,1.0") still remain in the queue.

Next, when "SCPI.Enter Val, "#" is executed, the first data item only is read and substituted into Val (Val = "E4991A"). At this point, the 3rd data onward ("113,1.0") still remain in the queue.

Finally, when "SCPI.Enter Val, "*" is executed, all of the data is cancelled and the queue becomes empty. At this point, Val = "E4991A" remains the same.

- When the data type is variant:

  It is possible to read the data divided with commas (,) as a string array by specifying "#" as the option parameter and executing the command. Refer to Example 18-25 for details.

Aim: Reading the entire data (array data) separated with commas.

To read all of the comma (,) separated data (array data), specify the data type of the variable as variant.

Example 18-25 **Specifying option parameter “#”**

Assume there are returned values ("1,2,3,4") of "SCPI.Output "DATA:RAW?" kept in the queue.

```
Dim Val as Variant
SCPI.Output "DATA:RAW?"
SCPI.Enter Val, "#"
```

When "SCPI.Enter Val, "#" is executed, all of the data is read in the form of a string array and substituted into Val (Val (0)=1, Val (1)=2, Val (2)=3 and Val (3)=4). At this point, the queue becomes empty.

Aim: Skipping data and emptying the queue

Basically, regardless of the specified data type of the variable, specifying only "*" as the option parameter and executing the command with the **Enter method** cancels all of the data, and the queue becomes empty.

- When the data type is numeric:

Example 18-26 Specifying option parameter “*” only

Assume there are returned values ("1,2,3,4") of "SCPI.Output "DATA:RAW?" kept in the queue.

```
Dim Dummy as Double
SCPI.Output "DATA:RAW?"
SCPI.Enter Dummy, "*"
```

When SCPI.Output Dummy "*" is executed, all of the data is cancelled and the queue becomes empty.

- When the data type is string:

Example 18-27 Specifying option parameter “*” only

Assume there are returned values ("Agilent, E4991A, 113,1.0") from "SCPI.Output "*IDN?" kept in the queue.

```
Dim Dummy as String
SCPI.Output "*IDN?"
SCPI.Enter Dummy, "*"
```

When SCPI.Output Dummy "*" is executed, all of the data is cancelled and the queue becomes empty.

- When the data type is variant:

Example 18-28 Specifying option parameter “*” only

Assume there are returned values ("1,2,3,4") of "SCPI.Output "DATA:RAW?" kept in the queue.

```
Dim Dummy as Variant
SCPI.Output "DATA:RAW?"
SCPI.Enter Dummy, "*"
```

When "SCPI.Output Dummy "*"is executed, all of the data is cancelled and the queue becomes empty.

A Manual Changes

This appendix contains the information required to adapt this manual to versions or configurations of the Agilent E4991A manufactured earlier than the current printing date of this manual. The information contained elsewhere in this manual applies directly to E4991A units bearing the serial number printed on this manual's title page.

Manual Changes

To adapt this manual to your E4991A, refer to Table A-1 and Table A-2.

Table A-1 Manual Changes by Serial Number

Serial Prefix or Number	Make Manual Changes
JP2KH or MY432	Change1
JP1KH, JP2KH or MY432	Change 2

Table A-2 Manual Changes by Firmware Version

Version	Make Manual Changes

Agilent Technologies uses a two-part, ten-character serial number that is stamped on the serial number plate (Figure A-1). The first five characters are the serial prefix and the last five digits are the suffix.

Figure A-1 Serial Number Plate

Change 1

Remote control using E4991A macros

This section describes the system structures and command sets used for controlling the E4991A and peripheral equipment with the instrument's macro functions.

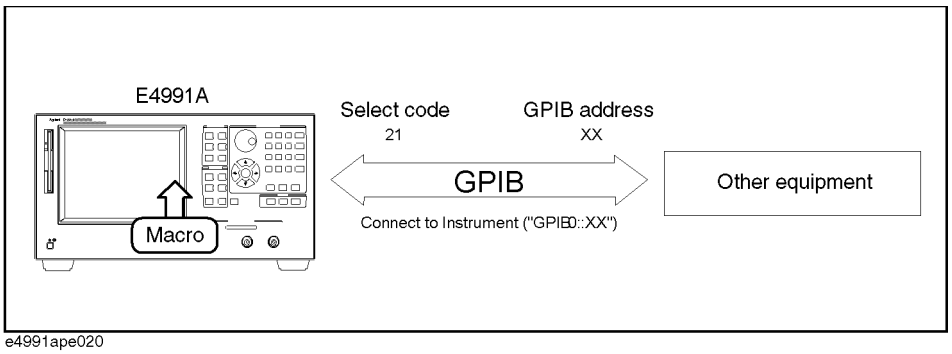
NOTE The E4991A is shipped with a macro function. A macro allows you to automatically execute a series of multiple commands with a single command. Using a macro allows you to combine the steps of a complicated procedure into a single step for a wide variety of applications. A macro can also be used to control peripheral equipment. The E4991A VBA (Visual Basic for Application) is the programming language used to execute macro functions.

System structure

Connect the E4991A to any peripheral equipment that can be connected with a GPIB cable.

An outline of a remote control system using the macro functions is shown in ê} A-2.

Figure A-2 **Structure example of GPIB remote control system**



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Required equipment

1. The Agilent E4991A RF Impedance/Material Analyzer and the accessories required to measure a DUT

When using macro functions to control the E4991A, it is not necessary to select the system-controller mode or the addressable-only mode of the GPIB system.

However, to control peripheral equipment other than the E4991A, you must set the E4991A to the system-controller mode because control is done through the internal GPIB bus.

When the E4991A is used as the system controller, set the E4991A to system-controller mode and set the GPIB address as the system controller. This setting is made by the following front panel operation.

a. Set the E4991A to system-controller mode.

   System - **GPIB Setup...** - Control Mode [System Controller]

b. Set the GPIB address of the system controller.

   System - **GPIB Setup...** - Control Address: (drop-down box)

c. Turn the E4991A's main power off and then back on again.

2. Peripheral equipment depending on the user's purpose
3. GPIB cable (10833A/B/C/D) to connect the E4991A and peripheral equipment

Size and configuration of possible GPIB systems

For information on the type of GPIB system that can be constructed for controlling peripheral equipment, refer to "For information on the type of GPIB system that can be constructed for controlling peripheral equipment, refer to ." on page 551.

How to operate macros

It is necessary to understand the basics of E4991A VBA, which is the programming language used for writing and executing macros. E4991A VBA is briefly explained in Chapter 13, "Use of Macros," on page 211. Refer to E4991A VBA help for more detailed

information on the basics of E4991A VBA programming, standard control, and functions.

Change 2

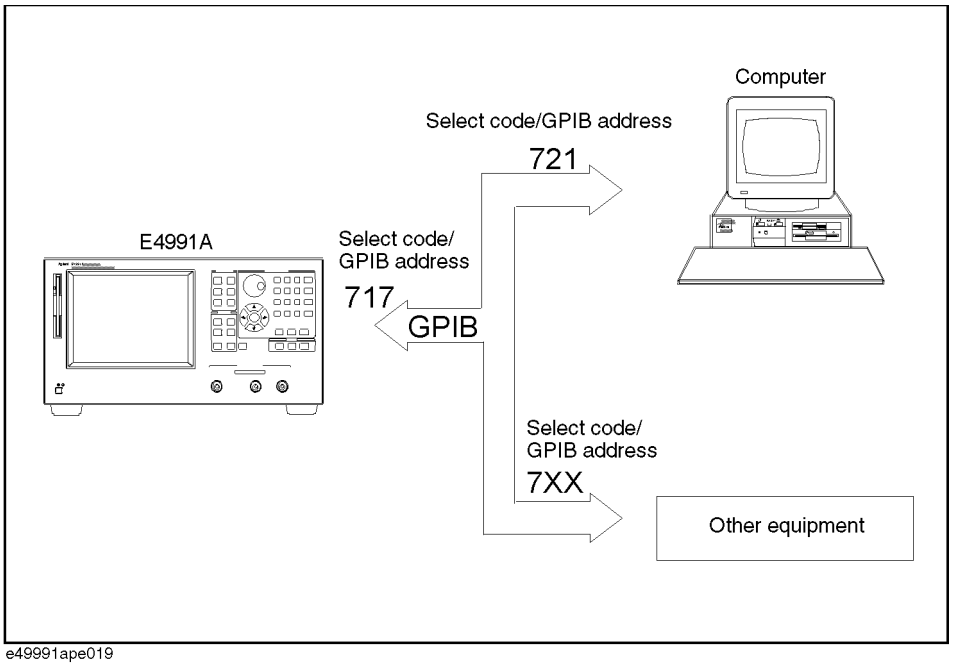
Outline of GPIB remote control system

This section explains the system structures and required equipment for sending GPIB command messages. In Chapter 17, you can also find more on the GPIB commands used to control the E4991A from an external computer through the GPIB interface.

System structure

Connect the E4991A to an external computer and peripheral equipment with a GPIB cable. Figure A-3 outlines the system structure for the GPIB remote control system.

Figure A-3 **Structure example of GPIB remote control system**



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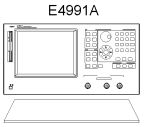
What is GPIB?
GPIB (General-Purpose Interface Bus) is an interface standard for connecting computers and peripheral equipment. It supports worldwide standards such as IEEE 488.1, IEC-625, IEEE 488.2 and JIS-C1901. By using the GPIB interface, the E4991A can be controlled from an external computer. The computer sends commands and instructions to the E4991A and receives data sent from it through GPIB.

Required Equipment

1. The Agilent E4991A RF Impedance/Material Analyzer and the accessories required to measure a DUT



When using an external computer as the system controller, it is necessary to set the E4991A in addressable-only mode and set the GPIB address as required. This setting is made by the following front panel operation.

a. Set the E4991A in addressable-only mode.

System - **GPIB Setup...** - Control Mode [Addressable Only]

b. Set the GPIB address of the E4991A.

System - **GPIB Setup...** - E4991A Address: (drop-down box)

c. Turn the E4991A's main power off and then back on again.

2. GPIB system controller

To use an external computer as the system controller, a Personal Computer (IBM compatible) or work station with a GPIB interface is required. Also, software such as Agilent VEE, Microsoft Visual Basic, or HTBasic is required to control the E4991A through GPIB.

3. Peripheral equipment depending on the user's purpose
4. GPIB cable (10833A/B/C/D) to connect the computer to the E4991A and peripheral equipment

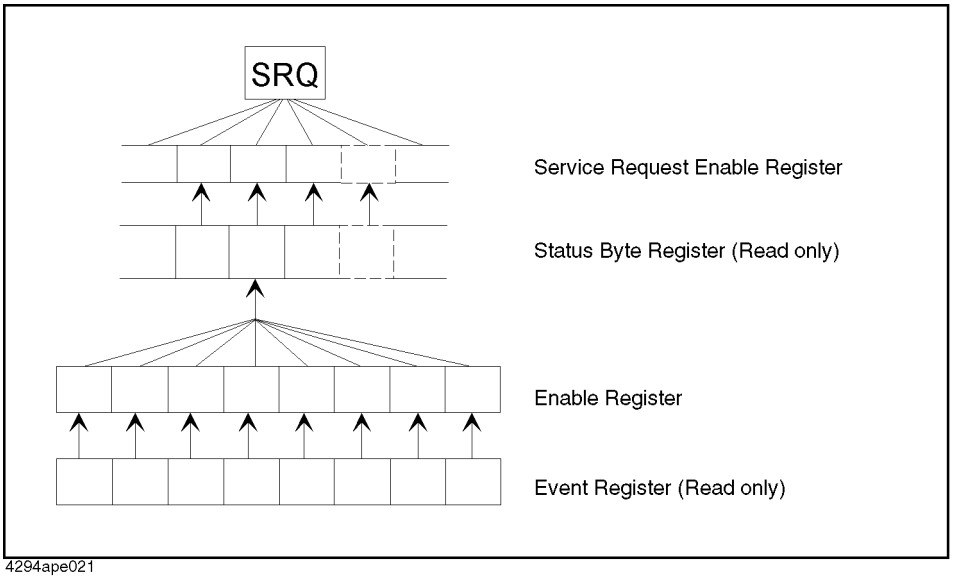
B GPIB Status Report System

This appendix describes the status report system in the Agilent E4991A GPIB system.

General Model of Status Registers

The E4991A has a status report system that notifies users of its states.

Figure B-1 **General Model of Status Registers**



The status report system has a hierarchical structure as shown in Figure B-1. When the instrument meets a certain condition, the corresponding bit in the appropriate event register is set to 1. By monitoring event registers, users can grasp the state of the instrument.

If a bit in an event register is set to 1 and the corresponding bit (indicated by arrows in Figure B-1) in the enable register in the upper level is also set to 1, the summary bit of the Status Byte Register is set to 1. The state of the Status Byte Register can be obtained through serial poll.

If a bit in the Service Request Enable Register is set 1, a service request (SRQ) occurs when the corresponding bit in the Status Byte Register is set to 1. The SRQ informs the controller that the E4991A is requesting a service and a program to handle interrupt when the SRQ is generated. For how to use the SRQ, see “Using the Status Register” on page 112 or “Using Status Report Mechanism” on page 203.

Event Registers

The bits in an event register reflect corresponding the E4991A states such as event occurrence. These bits are used to constantly monitor the E4991A state changes, and if a certain condition defined for each bit is met, the corresponding bit is changed to 1. Note that no GPIB command can change the status of event register bits.

The E4991A has the following types of event registers.

- Standard Event Status Register (For details, refer to Table B-2)
- Operation Status Event Register (For details, refer to Table B-3)
- Questionable Status Event Register (For details, refer to Table B-4)
- Questionable Status Hardware Event Register (For details, refer to Table B-5)
- Questionable Status Limit Event Register (For details, refer to Table B-6)
- Questionable Status Search Event Register (For details, refer to Table B-7)

Enable Registers

By setting the bit(s) in an enable register, the user can select bit(s) of an event register that can set the summary bit in the Status Byte Register to 1 when an event has occurred. In other words, enable register bits can function as mask bits, enabling the event register bits corresponding to all of the enable register bits to be set to 1.

For example, you can specify that the summary bit in the Status Byte Register be set to 1 only when the bit in a certain event register is set to 1 by setting the corresponding enable register bit to 1.

Status Byte Register

When an event register bit enabled by the corresponding enable register bit is set to 1, the corresponding summary bit in the Status Byte Register is also set to 1. In addition to the summary bit for the event register, the Status Event Register has a bit indicating the status of the output queue and a bit indicating SRQ status.

The Status Byte Register value can be read with the ***STB?** command or serial poll (SPOLL statement in HTBasic) from the controller.

When the ***STB?** command is used to read the Status Byte Register, the content of the register is not changed. On the other hand, when the SPOLL statement in HTBasic is used to read a Status Byte Register, the RQS bit in the Status Byte Register is cleared.

Table B-1 shows the content of the Status Byte Register in the E4991A. The serial poll reads bit 6 of the Status Byte Register as an RQS bit. On the other hand, the ***STB?** command reads bit 6 as an MSS bit. For details on RQS and MSS bits, refer to Table B-1.

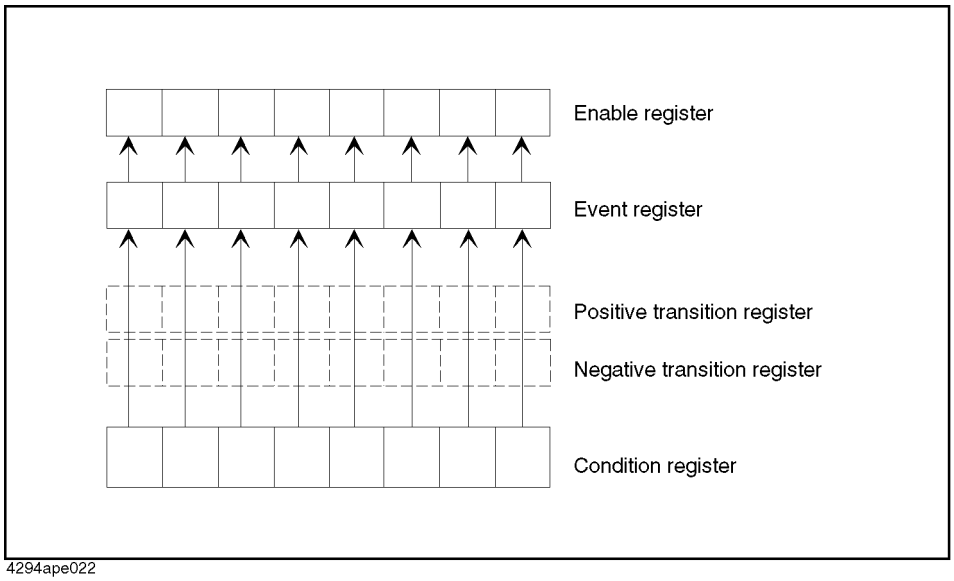
In addition, by setting the bit(s) in the Service Request Enable Register, service requests can be generated in conjunction with the Status Byte Register.

Transition Filter and Condition Register

The E4991A status transition filter allows the user to select the transition direction of a bit's status in the status register, which sets the bit in the event register.

If the status register has transition filters, a lower level register called "condition register" exists under the event register. The transition filer lies between the event register and the condition register. The transition filter allows the corresponding event register bit to be set according to the positive transition, negative transition, or both of a bit in the condition register. For example, when a negative transition filter is set, if a negative transition has occurred in a bit of a condition register, that is, a bit in the condition register has changed from 1 to 0, the corresponding bit in the event register of the upper level is set to 1.

Figure B-2 **Status Transition Filter and Condition Register**



In the E4991A, the Operation Status Register and the Questionable Status Register have transition filters (Figure B-3). By monitoring status transition in bit 4 of the Operation Status Register, transition filters allow generation of an SRQ when the E4991A starts or stops measurement.

Status Register Structure

Status registers have the structure shown in Figure B-3 and Figure B-4. The Status Byte Register has summary bits for the registers in the lower level. This section explains each layer in the E4991A's status register structure. For details on each bit in each status register, see Table B-1 to Table B-7.

Figure B-3 Status Register Structure (1/2)

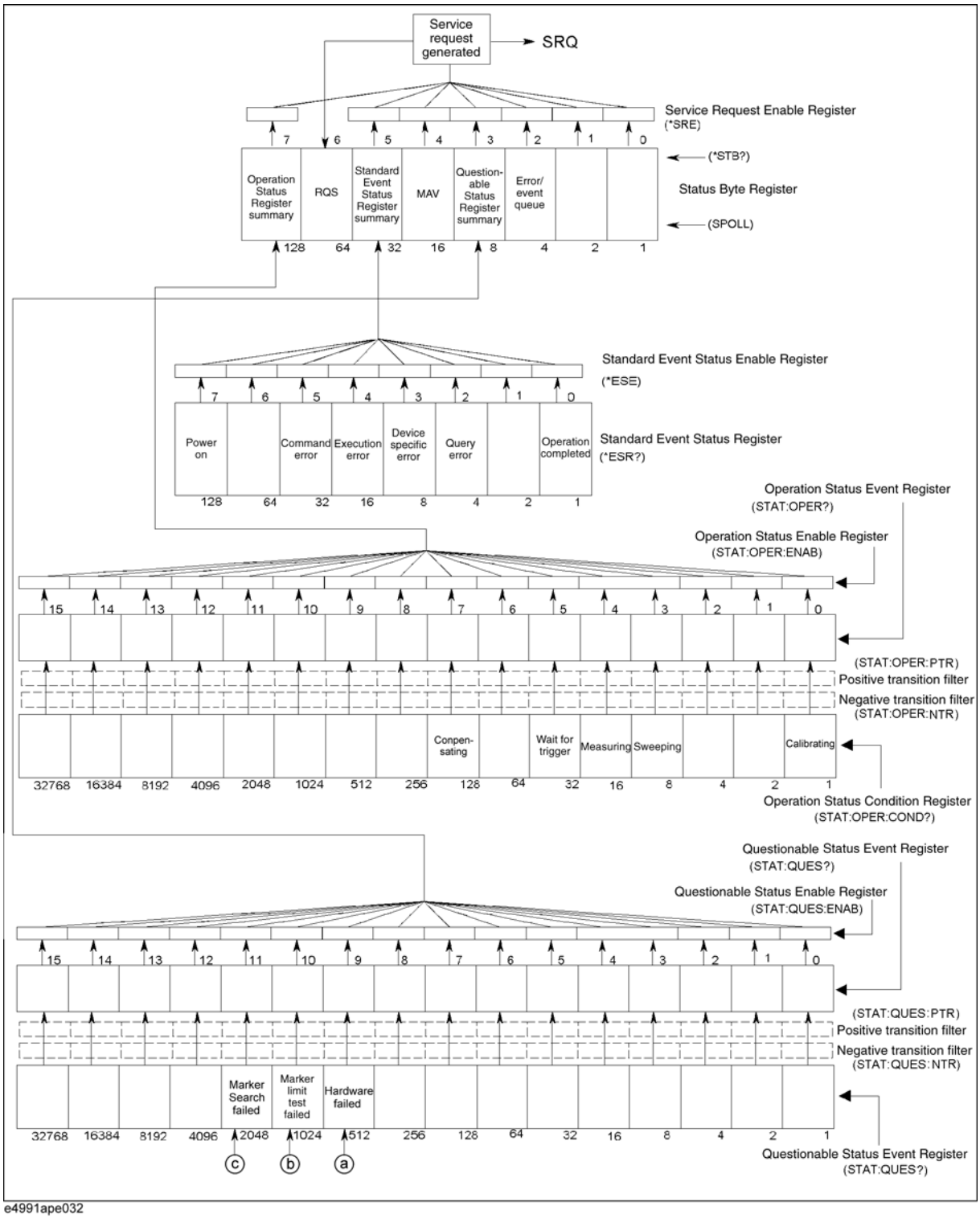

Service request generated
SRQ
Service Request Enable Register (*SRE)
7 6 5 4 3 2 1 0
Operation Status Register summary
RQS
Standard Event Status Register summary
MAV
Question-able Status Register summary
Error/ event queue
(*STB?)
Status Byte Register
(SPOLL)
128 64 32 16 8 4 2 1
Standard Event Status Enable Register (*ESE)
Power on
Command error
Execution error
Device specific error
Query error
Operation completed
Standard Event Status Register (*ESR?)
Operation Status Event Register (STAT:OPER?)
Operation Status Enable Register (STAT:OPER:ENAB)
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
(STAT:OPER:PTR)
Positive transition filter
Negative transition filter (STAT:OPER:NTR)
Conpen-sating
Wait for trigger
Measuring
Sweeping
Calibrating
32768 16384 8192 4096 2048 1024 512 256 128 64 32 16 8 4 2 1
Operation Status Condition Register (STAT:OPER:COND?)
Questionable Status Event Register (STAT:QUES?)
Questionable Status Enable Register (STAT:QUES:ENAB)
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
(STAT:QUES:PTR)
Positive transition filter
Negative transition filter (STAT:QUES:NTR)
Marker Search failed
Marker limit test failed
Hardware failed
32768 16384 8192 4096 2048 1024 512 256 128 64 32 16 8 4 2 1
c b a
Questionable Status Event Register (STAT:QUES?)

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Figure B-4 Status Register Structure (2/2)

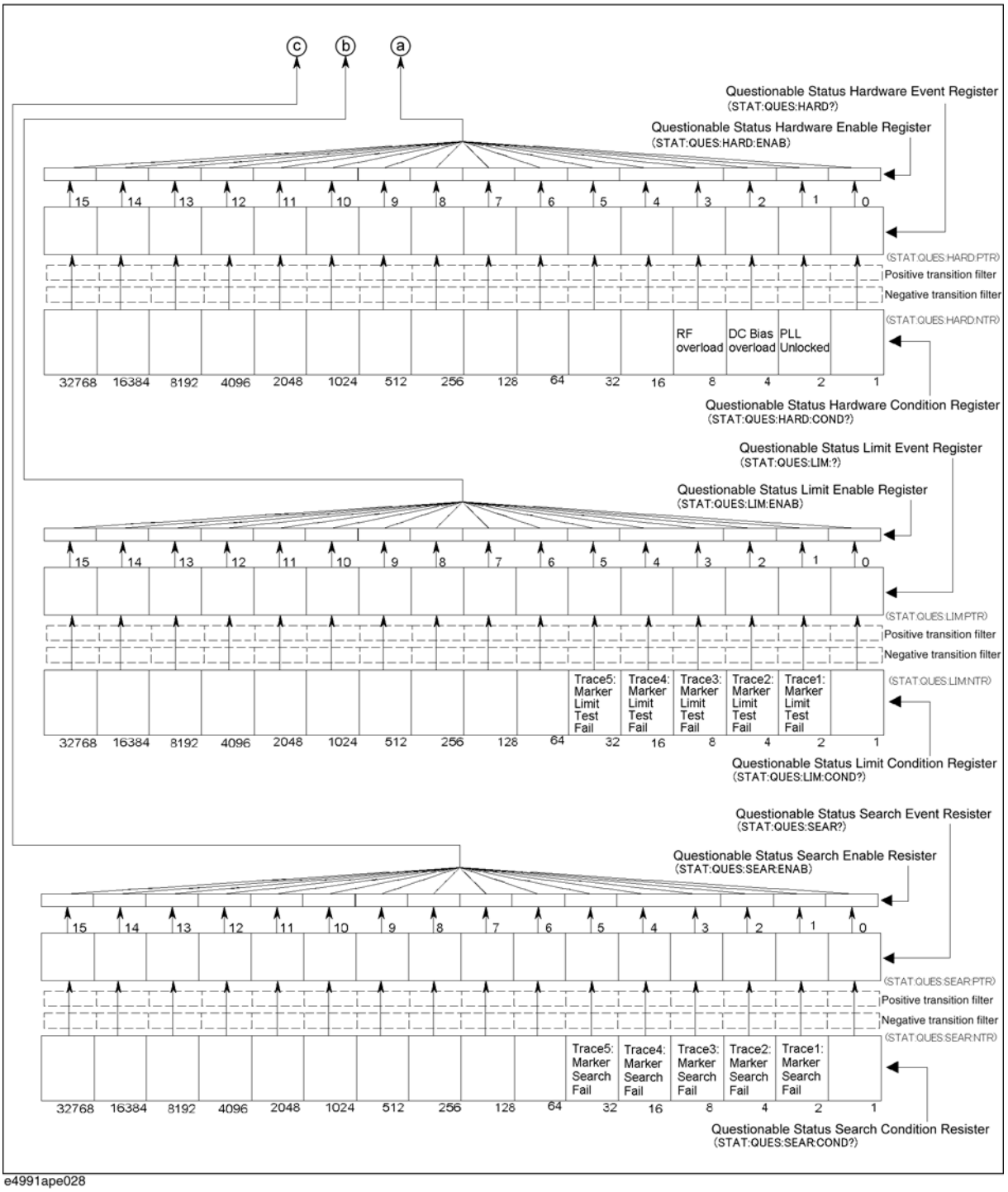
c
b
a
Questionable Status Hardware Event Register
(STAT:QUES:HARD?)
Questionable Status Hardware Enable Register
(STAT:QUES:HARD:ENAB)
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
(STAT:QUES:HARD:PTR)
Positive transition filter
Negative transition filter
(STAT:QUES:HARD:NTR)
RF overload
DC Bias overload
PLL Unlocked
32768 16384 8192 4096 2048 1024 512 256 128 64 32 16 8 4 2 1
Questionable Status Hardware Condition Register
(STAT:QUES:HARD:COND?)
Questionable Status Limit Event Register
(STAT:QUES:LIM:?)
Questionable Status Limit Enable Register
(STAT:QUES:LIM:ENAB)
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
(STAT:QUES:LIM:PTR)
Positive transition filter
Negative transition filter
Trace5: Marker Limit Test Fail
Trace4: Marker Limit Test Fail
Trace3: Marker Limit Test Fail
Trace2: Marker Limit Test Fail
Trace1: Marker Limit Test Fail
(STAT:QUES:LIM:NTR)
32768 16384 8192 4096 2048 1024 512 256 128 64 32 16 8 4 2 1
Questionable Status Limit Condition Register
(STAT:QUES:LIM:COND?)
Questionable Status Search Event Resister
(STAT:QUES:SEAR?)
Questionable Status Search Enable Resister
(STAT:QUES:SEAR:ENAB)
15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0
(STAT:QUES:SEAR:PTR)
Positive transition filter
Negative transition filter
(STAT:QUES:SEAR:NTR)
Trace5: Marker Search Fail
Trace4: Marker Search Fail
Trace3: Marker Search Fail
Trace2: Marker Search Fail
Trace1: Marker Search Fail
32768 16384 8192 4096 2048 1024 512 256 128 64 32 16 8 4 2 1
Questionable Status Search Condition Resister
(STAT:QUES:SEAR:COND?)

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Table B-1 Status Bit Definition of Status Byte Register

Bit position	Name	Description
0-1	Not used	Always 0.
2	Error/Event Queue	Set to 1 when the error/event queue contains data; reset to 0 when all of the data has been retrieved.
3	Questionable Status Register Summary Bit	Set to 1 when one of the enabled bits in the Questionable Status Register is set to 1.
4	MAV (Message Available)	Set to 1 when there is information waiting to be output and still not read. When the information is read, this bit is set to 0.
5	Standard Event Status Register Summary Bit	Set to 1 when one of the enabled bits in the Standard Event Status Register is set to 1.
6	RQS (Serial poll is used to read the Status Byte Register)	Set to 1 when E4991A generates SRQ. When the Status Byte Register is read by serial poll, this bit is set to 0.
	MSS (***STB?** is used to read the Status Byte Register)	Set to 1 when one of the bits in the Status Byte Register enabled by the Service Request Enable Register is set to 1.
7	Operation Status Register Summary Bit	Set to 1 when one of the enabled bits in the Operation Status Register is set to 1.

When the ***CLS** command is executed, each bit in the Status Byte Register is cleared.

Table B-2 Status Bit Definition of Standard Event Status Register

Bit position	Name	Description
0	Operation Compete bit	Set to 1 upon completion of all operations done by commands that proceed the ***OPC?** command.
1	Not used	Always 0.
2	Query Error Bit	1. Set to 1 when the E4991A has no transferred data in the output queue in spite of a Query request. 2. Set to 1 when transferred data in the E4991A output queue have been lost because of an incoming new message.
3	Device Dependent Error Bit	Set to 1 when an error other than command errors, Query errors, and execution errors has occurred.
4	Execution Error	1. Set to 1 when a specified parameter in a GPIB command is out of range or cannot be processed by the E4991A. 2. Set to 1 when a GPIB command cannot be executed correctly because of the E4991A's state.
5	Command Error Bit	1. Set to 1 when an IEEE 488.2 syntax error has occurred (a command sent to E4991A does not conform to the syntax stipulated by the IEEE 488.2 standard). Possible reasons are that a command parameter does not conform to the E4991A listen format or it is of a type E4991A cannot accept. 2. Set to 1 when a semantic error has occurred. Possible reasons are that a command sent to the E4991A has a misspelling or is an IEEE 488.2 command that E4991A cannot process. 3. Set to 1 when GET (Group Execution Trigger) is input to a program input buffer.
6	Not used	Always 0
7	Power ON Bit	Set to 1 when the E4991A is powered on.

When the ***CLS** command is executed, each bit in the Standard Event Status Register is cleared.

Table B-3 Status Bit Definition of Operation Status Event Register

Bit position	Name	Description
0	Calibrating	Set to 1 when the E4991A is measuring calibration data. When measurement is completed, this bit is set to 0.
1-2	Not used	Always 0.
3	Sweeping	Set to 1 when the E4991A is sweeping. When sweep is completed, this bit is set to 0.
4	Measuring	Set to 1 when the E4991A is measuring. When measurement is completed, this bit is set to 0. In the case of using the sweep averaging function, when sweep averaging is completed, this bit is set to 0 for the first time.
5	Waiting for Trigger	Set to 1 while waiting for trigger.
6	Not used	Always 0.
7	Compensating	Set to 1 when the E4991A is measuring fixture compensation data. When measurement is completed, this bit is set to 0.
8-15	Not used	Always 0.

When the ***CLS** command is executed, each bit in the Operation Status Event Register is cleared.

Table B-4 Status Bit Definition of Questionable Status Event Register

Bit position	Name	Description
0-8	Not used	Always 0.
9	Measurement Failure	Set to 1 when a measurement failure has been detected in the E4991A.
10	Marker Limit Test Fail	Set to 1 when a marker limit test has failed.
11	Marker Search Fail	Set to 1 when a marker search has failed.
12-15	Not used	Always 0.

When the ***CLS** command is executed, each bit in the Questionable Status Event Register is cleared.

Table B-5 Status Bit Definition of Questionable Status Hardware Event Register

Bit position	Name	Description
0	Not used	Always 0.
1	PLL Unlocked	Set to 1 when an unlocked phase lock loop has been detected in the E4991A.
2	DC Bias Overload	Set to 1 when dc bias current exceeding the maximum current limit is supplied or dc bias voltage exceeding the maximum voltage limit is detected.
3	RF Overload	Set to 1 when overload has been detected in the E4991A internal circuit.
4-15	Not used	Always 0.

When the ***CLS** command is executed, each bit in the Questionable Status Hardware Event Register is cleared.

Table B-6 Status Bit Definition of Questionable Status Limit Event Register

Bit position	Name	Description
0	Not used	Always 0.
1	Trace 1: Marker Limit Test Fail	Set to 1 when the marker limit test has failed in trace 1.
2	Trace 2: Marker Limit Test Fail	Set to 1 when the marker limit test has failed in trace 2.
3	Trace 3: Marker Limit Test Fail	Set to 1 when the marker limit test has failed in trace 3.
4	Trace 4: Marker Limit Test Fail	Set to 1 when the marker limit test has failed in trace 4.
5	Trace 5: Marker Limit Test Fail	Set to 1 when the marker limit test has failed in trace 5.
6-15	Not used	Always 0

When the ***CLS** command is executed, each bit in the Questionable Status Limit Event Register is cleared.

Table B-7 Status Bit Definition of Questionable Status Search Event Register

Bit position	Name	Description
0	Not used	Always 0.
1	Trace 1: Marker Search Fail	Set to 1 when the marker search has failed in trace 1.
2	Trace 2: Marker Search Fail	Set to 1 when the marker search has failed in trace 2.
3	Trace 3: Marker Search Fail	Set to 1 when the marker search has failed in trace 3.
4	Trace 4: Marker Search Fail	Set to 1 when the marker search has failed in trace 4.
5	Trace 5: Marker Search Fail	Set to 1 when the marker search has failed in trace 5.
6-15	Not used	Always 0

When the ***CLS** command is executed, each bit in the Questionable Status Limit Event Register is cleared.

C GPIB Command List By Function

This appendix lists the Agilent E4991A GPIB commands according to function.

GPIB Command List By Function

GPIB Command List By Function

Function	Item to be set or executed				GPIB command
Measurement Conditions	Preset	Turns off the continuous activation of the trigger system.			***RST** on page 282
		Turns on the continuous activation of the trigger system.			**SYST:PRES** on page 523
	Selects measurement mode (Impedance/Dielectric/Magnetic measurement).				**MODE** on page 393
	Material measurement (Option 002)	Material thickness for dielectric material measurement			**CALC:FORM:PAR:DIE** on page 300
		DUT sizes for magnetic material measurement			**CALC:FORM:PAR:MAG** on page 302
	Selects measurement parameters.				**CALC{1-5}:FORM** on page 298
	Display format	Selects display format			**DISP:TRAC{1-5}:GRAT:FORM** on page 357
		Selects Y-axis formats in scalar trace.			**DISP:TRAC{1-3}:Y:SPAC** on page 371
	Phase measurement	Selects unit.			**CALC{1-5}:FORM:UNIT:ANGL** on page 303
		Turns on/off expanded phase display.			**CALC{1-3}:FORM:PAR:EPH** on page 301
	Sweep	Selects sweep parameter (sweep type).			**SWE:TYPE** on page 515
		Number of Measurement points			**SWE:POIN** on page 511
		Direction			**SWE:DIR** on page 508
		Sweep time	Turns on/off the automatic setting.		**SWE:TIME:AUTO** on page 514
			Sets sweep time		**SWE:TIME** on page 513
		Delay time	For each sweep		**SWE:DWEL1** on page 508
			For each measurement point		**SWE:DWEL2** on page 509
		Frequency sweep range	Start/stop	Start value	**FREQ:STAR** on page 378
				Stop value	**FREQ:STOP** on page 379
			Center/span	Center value	**FREQ:CENT** on page 376
				Span value	**FREQ:SPAN** on page 377
			Full span		**FREQ:SPAN:FULL** on page 377
		Oscillator current level sweep range	Mode (Sweep)		**SOUR:CURR:MODE** on page 460
			Start/stop	Start value	**SOUR:CURR:STAR** on page 468
				Stop value	**SOUR:CURR:STOP** on page 469
			Center/span	Center value	**SOUR:CURR:CENT** on page 458
				Span value	**SOUR:CURR:SPAN** on page 467
		Oscillator voltage level sweep range	Mode (Sweep)		**SOUR:VOLT:MODE** on page 479
			Start/stop	Start value	**SOUR:VOLT:STAR** on page 487
				Stop value	**SOUR:VOLT:STOP** on page 488
			Center/span	Center value	**SOUR:VOLT:CENT** on page 477
				Span value	**SOUR:VOLT:SPAN** on page 486
		Oscillator power level sweep range	Mode (Sweep)		**SOUR:POW:MODE** on page 472
			Start/stop	Start value	**SOUR:POW:STAR** on page 474
				Stop value	**SOUR:POW:STOP** on page 475
			Center/span	Center value	**SOUR:POW:CENT** on page 471
				Span value	**SOUR:POW:SPAN** on page 473

Function	Item to be set or executed				GPIB command
Measurement conditions	Sweep	dc bias current sweep range (Option 001)	On/Off		**SOUR:CURR:OFFS:STAT** on page 465
			Start/stop	Start value	**SOUR:CURR:OFFS:STAR** on page 464
				Stop value	**SOUR:CURR:OFFS:STOP** on page 466
			Center/span	Center value	**SOUR:CURR:OFFS:CENT** on page 462
				Span value	**SOUR:CURR:OFFS:SPAN** on page 463
			Maximum voltage limit		**SOUR:VOLT:LIM:OFFS** on page 478
		dc bias voltage sweep range (Option 001)	On/Off		**SOUR:VOLT:OFFS:STAT** on page 484
			Start/stop	Start value	**SOUR:VOLT:OFFS:STAR** on page 483
				Stop value	**SOUR:VOLT:OFFS:STOP** on page 485
			Center/span	Center value	**SOUR:VOLT:OFFS:CENT** on page 481
				Span value	**SOUR:VOLT:OFFS:SPAN** on page 482
			Maximum current limit		**SOUR:CURR:LIM:OFFS** on page 459
	Oscillator	CW frequency			**FREQ** on page 375
		Current level	Mode (Fix)		**SOUR:CURR:MODE** on page 460
			Output level		**SOUR:CURR** on page 457
		Voltage level	Mode (Fix)		**SOUR:VOLT:MODE** on page 479
			Output level		**SOUR:VOLT** on page 476
		Power level	Mode (Fix)		**SOUR:POW:MODE** on page 472
			Output level		**SOUR:POW** on page 470
	dc bias (Option 001)	Fixed voltage source	On/Off		**SOUR:VOLT:OFFS:STAT** on page 484
			Output level		**SOUR:VOLT:OFFS** on page 480
			Maximum current limit		**SOUR:CURR:LIM:OFFS** on page 459
		Fixed current source	On/Off		**SOUR:CURR:OFFS:STAT** on page 465
			Output level		**SOUR:CURR:OFFS** on page 461
			Maximum voltage limit		**SOUR:VOLT:LIM:OFFS** on page 478
		Turns on/off the monitor function.			**CALC:BMON** on page 291
	Averaging function	Point averaging	On/Off		**AVER** on page 287
			Factor		**AVER:COUN** on page 288
		Sweep averaging	On/Off		**CALC:AVER** on page 289
			factor		**CALC:AVER:COUN** on page 290
			Restart		**CALC:AVER:CLE** on page 289

GPIB Command List By Function

Function	Item to be set or executed				GPIB command
Measurement conditions	Only Segment sweep	Segment sweep table	Add segment.		**SEGM:COUN** on page 397
			Delete all segments.		**SEGM:DEL:ALL** on page 406
			Number of measurement points	Setting	**SEGM{1-16}:SWE:POIN** on page 413
				Read total number.	**SWE:POIN** on page 511
			Frequency sweep range	Start value	**SEGM{1-16}:FREQ:STAR** on page 409
				Stop value	**SEGM{1-16}:FREQ:STOP** on page 410
				Center value	**SEGM{1-16}:FREQ:CENT** on page 407
				Span value	**SEGM{1-16}:FREQ:SPAN** on page 408
			Oscillator current level	Mode On/Off	**SEGM:CURR:STAT** on page 402
				Output level	**SEGM{1-16}:CURR** on page 398
			Oscillator voltage level	Mode On/Off	**SEGM:VOLT:STAT** on page 418
				Output level	**SEGM{1-16}:VOLT** on page 414
			Oscillator power level	Mode On/Off	**SEGM:POW:STAT** on page 412
				Output level	**SEGM{1-16}:POW** on page 411
			dc bias (Fixed current source) (Option 001)	On/Off	**SOUR:CURR:OFFS:STAT** on page 465
				Mode On/Off	**SEGM:CURR:OFFS:STAT** on page 399
				Output level	**SEGM{1-16}:CURR:OFFS** on page 401
				Maximum voltage limit	**SEGM{1-16}:VOLT:LIM** on page 415
			dc bias (Fixed voltage source) (Option 001)	On/Off	**SOUR:VOLT:OFFS:STAT** on page 484
				Mode On/Off	**SEGM:VOLT:OFFS:STAT** on page 417
				Output level	**SEGM{1-16}:VOLT:OFFS** on page 416
				Maximum current limit	**SEGM{1-16}:CURR:LIM** on page 400
			Number of point averaging		**SEGM{1-16}:AVER:COUN** on page 396
			Sets parameter values collectively for a specified segment number.		**SEGM{1-16}:DATA** on page 403
			Sets parameter values collectively for all segments.		**SEGM:DATA:ALL** on page 405
		Delay time for each segment			**SWE:DWEL3** on page 510
		Sets frequency span display (Sort by frequency/For each segment).			**DISP:TRAC{1-5}:X:SPAC** on page 363
		Turns on/off the segment sweep table.			**DISP:TEXT{1-3}:SET** on page 356

Function	Item to be set or executed				GPIB command
Display screen	Entire view	Enable/Disable display update.			**DISP:ENAB** on page 354
		Text display screen	On/Off		**DISP:TEXT** on page 355
			Selection		**DISP:TEXT{1-3}:SET** on page 356
		Selects window format (Split window or Overlay).			**DISP:FORM** on page 355
		Turns on/off the backlight.			**DISP:BACK** on page 354
		Sets when display is refreshed	Refreshed for each sweep.		**SYST:IND:SWE:SET** on page 519
			Refreshed for each measurement point.		**SYST:IND:POIN:SET** on page 519
			Refreshed periodically.	On/Off	**SYST:IND:TIME:SET** on page 521
				Sets interval	**SYST:IND:TIME** on page 520
	Trace	On/Off			**DISP:TRAC{1-5}** on page 356
		Sets active trace.			**DISP:TRAC{1-5}:SEL** on page 358
		Selects display trace (Data/Memory/Both/Calculate results).			**CALC{1-5}:MATH:FUNC** on page 340
		Copies measurement data to memory.			**CALC{1-5}:MATH:MEM** on page 341
		Sets offset value by which data trace value is subtracted.			**CALC{1-3}:MATH:OFFS** on page 342
		List on measurement screen.	On/Off		**DISP:TRAC{1-5}:TEXT** on page 359
			Page scroll		**DISP:TRAC{1-5}:TEXT:PAGE** on page 359
		Trace title.	On/Off		**DISP:TRAC{1-5}:TITL** on page 360
			Entry		**DISP:TRAC{1-5}:TITL:DATA** on page 361

GPIB Command List By Function

Function	Item to be set or executed			GPIB command
Display screen	Scale	Selects trace to be displayed (Data/Memory/Couple).		**DISP:TRAC{1-5}:Y:FOR** on page 366
		Automatic scale adjustment	For each trace	**DISP:TRAC{1-5}:Y:AUTO** on page 364
			For all traces	**DISP:TRAC:Y:AUTO:ALL** on page 364
		Linear Y-axis format (Scalar trace)	Max/Min	Maximum value	**DISP:TRAC{1-3}:Y:TOP** on page 372
				Minimum value	**DISP:TRAC{1-3}:Y:BOTT** on page 365
				Reference line's position	**DISP:TRAC{1-3}:Y:RPOS** on page 370
				Enable/Disable reference line.	**DISP:TRAC{1-3}:REF** on page 358
			Full scale /Reference value	Full scale value	**DISP:TRAC{1-5}:Y:FULL** on page 367
				Reference value	**DISP:TRAC{1-5}:Y:RLEV** on page 369
				Reference line's position	**DISP:TRAC{1-3}:Y:RPOS** on page 370
				Enable/Disable reference line.	**DISP:TRAC{1-3}:REF** on page 358
		Log Y-axis format (Scalar trace)	Maximum value		**DISP:TRAC{1-3}:Y:TOP** on page 372
			Minimum value		**DISP:TRAC{1-3}:Y:BOTT** on page 365
		Complex plane format (Complex trace)	X-axis reference value		**DISP:TRAC{4-5}:X:RLEV** on page 362
			Y-axis reference value		**DISP:TRAC{1-5}:Y:RLEV** on page 369
			Full scale value		**DISP:TRAC{1-5}:Y:FULL** on page 367
		Polar format (Complex trace)	Full scale value		**DISP:TRAC{1-5}:Y:FULL** on page 367

Function	Item to be set or executed				GPIB command
Calibration	Calibration kit	Selects Load standard (7-mm/User-defined/Dielectric material measurement).			**SENS:CORR1:CKIT** on page 420
		Defines standard value by user.	Turns on/off list setting function.		**SENS:CORR1:CKIT:LIST** on page 421
			Defines impedance value using list setting.	Open (G)	**SENS:CORR2:CKIT:STAN1:LIST:G** on page 444
				Open (B)	**SENS:CORR1:CKIT:STAN1:LIST:B** on page 424
				Short (R)	**SENS:CORR1:CKIT:STAN2:LIST:R** on page 427
				Short (X)	**SENS:CORR1:CKIT:STAN2:LIST:X** on page 428
				Load (R)	**SENS:CORR1:CKIT:STAN3:LIST:R** on page 431
				Load (X)	**SENS:CORR1:CKIT:STAN3:LIST:X** on page 432
			Defines impedance value without using list setting.	Open (G)	**SENS:CORR1:CKIT:STAN1:G** on page 423
				Open (C)	**SENS:CORR1:CKIT:STAN1:C** on page 422
				Short (R)	**SENS:CORR1:CKIT:STAN2:R** on page 429
				Short (L)	**SENS:CORR1:CKIT:STAN2:L** on page 426
				Load (R)	**SENS:CORR1:CKIT:STAN3:R** on page 433
				Load (L)	**SENS:CORR1:CKIT:STAN3:L** on page 430
			Defines Load standard value for dielectric measurement (Option 002).	Relative permittivity	**SENS:CORR1:CKIT:STAN7:PRE** on page 435
				Dielectric loss factor	**SENS:CORR1:CKIT:STAN7:PLF** on page 434
				Thickness	**SENS:CORR1:CKIT:STAN7:THIC** on page 436
	Calibration data/calibration coefficient	Data measurement points			**SENS:CORR1:COLL:FPO** on page 438
		Measures calibration data.			**SENS:CORR1:COLL** on page 437
		Clears calibration data array/calibration coefficient array.			**SENS:CORR1** on page 419
		Calculates calibration coefficients and turns on calibration function.			**SENS:CORR1:COLL:SAVE** on page 439
Electric length compensation	Test fixture	Selects test fixture (Agilent test fixture/Custom).			**SENS:CORR2:FIXT** on page 454
		Reads electrical length of Agilent test fixture.			**SENS:CORR2:FIXT:EDEL:MODE:DIST?** on page 455
		Sets/Reads electrical length of custom test fixture.			**SENS:CORR2:FIXT:EDEL:USER:DIST** on page 456
	Other than test fixture	Sets offset time delay due to port extension.			**SENS:CORR2:EDEL:TIME** on page 453

GPIB Command List By Function

Function	Item to be set or executed				GPIB command
Fixture compensation	Fixture compensation kit	Defines standard value by user.	Turns on/off list setting function.		**SENS:CORR2:CKIT:LIST** on page 440
			Sets impedance value using list setting.	Open (G)	**SENS:CORR2:CKIT:STAN1:LIST:G** on page 444
				Open (B)	**SENS:CORR2:CKIT:STAN1:LIST:B** on page 443
				Short (R)	**SENS:CORR2:CKIT:STAN2:LIST:R** on page 446
				Short (X)	**SENS:CORR2:CKIT:STAN2:LIST:X** on page 447
			Sets impedance value without using list setting.	Open (G)	**SENS:CORR2:CKIT:STAN1:G** on page 442
				Open (C)	**SENS:CORR2:CKIT:STAN1:C** on page 441
				Short (R)	**SENS:CORR2:CKIT:STAN2:R** on page 448
				Short (L)	**SENS:CORR2:CKIT:STAN2:L** on page 445
	Fixture compensation data/fixture compensation coefficient	Data measurement points			**SENS:CORR2:COLL:FPO** on page 450
		Measures fixture compensation data.			**SENS:CORR2:COLL:FPO** on page 450
		Turns on/off fixture compensation function.	Open compensation		**SENS:CORR2:COLL:OPEN** on page 451
			Short compensation		**SENS:CORR2:COLL:SHOR** on page 452
		Calculates fixture compensation coefficients and turns on fixture compensation function.			**SENS:CORR2:COLL:SAVE** on page 451
Measurement	Trigger	Triggering	Available with Manual, External, or GPIB (BUS) trigger		**TRIG** on page 525
			Available with GPIB (BUS) trigger		***TRG** on page 284
		Trigger system	Reset		**ABOR** on page 286
			Turns on/off continuous activation.		**INIT:CONT** on page 382
			Initiate once		**INIT** on page 382
		Trigger source.			**TRIG:SOUR** on page 526
		Trigger event mode.			**TRIG:EVEN** on page 525
		Polarity of external trigger.			**TRIG:SLOP** on page 526

Function	Item to be set or executed			GPIB command
Marker	Turns off all makers.			**CALC{1-5}:MARK:AOFF** on page 305
	Turns on/off marker coupling function.			**CALC:MARK:COUP** on page 309
	Movement mode (Continuous/Discrete)			**CALC{1-5}:MARK:DISC** on page 309
	Objective trace selection (Data trace/Memory trace)			**CALC{1-5}:MARK:ON** on page 327
	Marker 1-8	On/Off		**CALC{1-5}:MARK{1-8}** on page 304
		Sets to active marker.		**CALC{1-5}:MARK{1-8}:ACT** on page 305
		Sets/reads stimulus value.		**CALC{1-5}:MARK{1-8}:X** on page 338
		Reads measurement value.		**CALC{1-5}:MARK{1-8}:Y?** on page 339
	Reference marker	On/Off		**CALC{1-5}:MARK:REF** on page 328
		Sets to active marker.		**CALC{1-5}:MARK:REF:ACT** on page 329
		Sets/reads stimulus value.		**CALC{1-5}:MARK:REF:X** on page 334
		Sets/reads measurement value (Fixed Δ mode only).		**CALC{1-5}:MARK:REF:Y** on page 335
	Δ mode	Selects mode (Off/Δ/Fixed Δ)		**CALC{1-5}:MARK:REF:TYPE** on page 333
	Sets sweep parameter by using stimulus/measurement value at active marker.			**CALC{1-5}:MARK:SET** on page 336
	Turns on/off marker list function,			**CALC{1-5}:MARK:LIST** on page 326
	Statistical analysis function	On/Off		**CALC{1-5}:MST** on page 343
		Reads analysis result.		**CALC{1-5}:MST:DATA?** on page 344
	Selects format when reading measurement value (Complex trace only).			**CALC{4-5}:MARK:FORM** on page 310
	Set unit of stimulus value at marker position.			**CALC{1-5}:MARK:UNIT** on page 337
	Limit test function	On/Off		**CALC{1-5}:MARK:FUNC:DOM:LIM:ALL** on page 314
		Marker 1-8	Turns on/off test marker.	**CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM** on page 313
			Upper limit of limit test	**CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:UP** on page 318
			Lower limit of limit test	**CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:LOW** on page 316
		Reference marker	Turns on/off test marker.	**CALC{1-5}:MARK:REF:FUNC:DOM:LIM** on page 329
			Upper limit of limit test	**CALC{1-5}:MARK:REF:FUNC:DOM:LIM:UP** on page 332
			Lower limit of limit test	**CALC{1-5}:MARK:REF:FUNC:DOM:LIM:LOW** on page 330
		Reads test results.	For all markers	**CALC{1-5}:MARK:FUNC:DOM:LIM:ALL:RES?** on page 315
			For specified marker 1-8	**CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:RES?** on page 317
			For reference marker	**CALC{1-5}:MARK:REF:FUNC:DOM:LIM:RES?** on page 331
		Displays test condition/test results for each marker.		**DISP:TEXT{1-3}:SET** on page 356

GPIB Command List By Function

Function	Item to be set or executed			GPIB command
Marker search function	Search definition/range	Partial search function	On/Off	**CALC{1-5}:MARK:FUNC:DOM** on page 312
			Sets active marker position to left boarder line.	**CALC{1-5}:MARK:FUNC:DOM:STAR** on page 320
			Sets active marker position to right boarder line.	**CALC{1-5}:MARK:FUNC:DOM:STOP** on page 320
			Range between reference marker and active marker.	**CALC{1-5}:MARK:FUNC:DOM:SPAN** on page 319
		Target value for target search		**CALC{1-5}:MARK:FUNC:TARG** on page 324
		Define peak value for peak search.	DX value	**CALC{1-5}:MARK:APE:EXC:X** on page 307
			DY value	**CALC{1-5}:MARK:APE:EXC:Y** on page 308
			Automatic definition using active marker	**CALC{1-5}:MARK:APE:SET** on page 306
	Turns on/off search tracking function.			**CALC{1-5}:MARK:FUNC:TRAC** on page 325
	Search	Selects what is searched for (Max/Min/Target/Positive peak/Negative peak).		**CALC{1-5}:MARK:FUNC** on page 311
		Execution (Max/Min/Target/Positive peak/Negative peak)		**CALC{1-5}:MARK:FUNC:EXEC** on page 321
		Search for the next highest peak.		**CALC{1-5}:MARK:FUNC:EXEC:NEXT** on page 322
		Search for target or peak on the right.		**CALC{1-5}:MARK:FUNC:EXEC:RIGH** on page 323
		Search for target or peak on the left.		**CALC{1-5}:MARK:FUNC:EXEC:LEFT** on page 322
Equivalent circuit analysis	Selects equivalent circuit model.			**CALC{1-5}:EPAR:CIRC** on page 296
	Performs analysis.			**CALC{1-5}:EPAR** on page 295
	Reads/Sets equivalent circuit parameters (Analysis results).			**CALC{1-5}:DATA:EPAR** on page 294
	Simulates frequency characteristics.			**CALC{1-5}:EPAR:SIM** on page 297

Function	Item to be set or executed				GPIB command
Read and write data	Data transfer	Selects format			**FORM:DATA** on page 374
		Sets byte order during binary transfer.			**FORM:BORD** on page 373
	Data array	Calibration	Reads calibration data array.		**DATA:CAD{1-8}?** on page 345
			Reads/Writes calibration coefficient array.		**DATA:CCO{1-6}** on page 346
		Fixture compensation	Reads fixture compensation data array.		**DATA:CMD{1-2}?** on page 347
			Reads/Writes fixture compensation coefficient array		**DATA:CMP{1-3}** on page 348
		Reads raw data array.			**DATA:RAW?** on page 349
	Data array for each segment (Segment sweep)	Calibration	Reads calibration data array.		**DATA:SEGM{1-16}:CAD{1-8}?** on page 350
			Reads/Writes calibration coefficient array.		**DATA:SEGM{1-16}:CCO{1-6}** on page 351
		Fixture compensation	Reads fixture compensation data array.		**DATA:SEGM{1-16}:CMD{1-2}?** on page 352
			Reads/Writes fixture compensation coefficient array.		**DATA:SEGM{1-16}:CMP{1-3}** on page 353
	Measurement results	Reads data trace array.			**CALC{1-5}:DATA?** on page 293
		Reads memory trace array.			**CALC{1-5}:DATA?** on page 293
		Reads dc bias level monitor array			**CALC:DATA:MON?** on page 292
		Reads stimulus array.			**SWE:STIM{1-4}?** on page 512
File-related	Reads list of files and folders.				**MMEM:CAT?** on page 383
	Save	State file			**MMEM:STOR** on page 388
		Trace data file	File format	Binary format	**MMEM:STOR:TRAC** on page 391
				ASCII format	**MMEM:STOR:TRAC:ASC** on page 391
			Selects internal data array.		**MMEM:STOR:TRAC:SEL{1-4}** on page 392
		Graphic data file	File format	JPEG format	**MMEM:STOR:GRAP** on page 389
				Bitmap format	**MMEM:STOR:GRAP:BMP** on page 390
		CITIfile			**MMEM:STOR:CITI{1-3}** on page 389
		Macro			**MMEM:STOR:MACR** on page 390
	Recall	State file			**MMEM:LOAD** on page 385
		Trace data file			**MMEM:LOAD:TRAC** on page 386
		Macro			**MMEM:LOAD:MACR** on page 385
	Folder	Change current directory.			**MMEM:CDIR** on page 383
		Create new			**MMEM:MDIR** on page 386
		Delete			**MMEM:RDIR** on page 388
	Files	Rename			**MMEM:MOVE** on page 387
		Copy			**MMEM:COPY** on page 384
		Delete			**MMEM:DEL** on page 384
Print	Graphic image	Selects print content.			**HCOP:CONT** on page 380
		Selects print mode.			**HCOP:IMAG** on page 381
	Output	Print			**HCOP** on page 380
		Cancel			**HCOP:ABOR** on page 380

GPIB Command List By Function

Function	Item to be set or executed		GPIB command
Macro	Returns a list of macros		**PROG:CAT?** on page 394
	Defines the macro name.		**PROG:NAME** on page 394
	Sets the macro status.		**PROG:STAT** on page 395
	Waits until the macro reaches the stop condition.		**PROG:WAIT** on page 395
Status report system	Clears register.		***CLS** on page 279
	Reads Status Byte Register.		***STB?** on page 283
	Sets Service Request Enable Register.		***SRE** on page 283
	Standard Event Status Register	Reads register value.	***ESR?** on page 280
		Sets enable register value.	***ESE** on page 280
		Sets OPC bit on operation termination.	***OPC** on page 281
	Operation Status Register	Reset	**STAT:PRES** on page 493
		Reads conditional register value.	**STAT:OPER:COND?** on page 489
		Sets enable register value.	**STAT:OPER:ENAB** on page 490
		Reads event register value.	**STAT:OPER?** on page 489
		Sets positive transition filter value.	**STAT:OPER:PTR** on page 492
		Sets negative transition filter value.	**STAT:OPER:NTR** on page 491
	Questionable Status Register	Reset	**STAT:PRES** on page 493
		Reads conditional register value.	**STAT:QUES:COND?** on page 493
		Sets enable register value.	**STAT:QUES:ENAB** on page 494
		Reads event register value.	**STAT:QUES?** on page 493
		Sets positive transition filter value.	**STAT:QUES:PTR** on page 504
		Sets negative transition filter value.	**STAT:QUES:NTR** on page 503
	Questionable Status Hardware Register	Reset	**STAT:PRES** on page 493
		Reads conditional register value.	**STAT:QUES:HARD:COND?** on page 495
		Sets enable register value.	**STAT:QUES:HARD:ENAB** on page 496
		Reads event register value.	**STAT:QUES:HARD?** on page 495
		Sets positive transition filter value.	**STAT:QUES:HARD:PTR** on page 498
		Sets negative transition filter value.	**STAT:QUES:HARD:NTR** on page 497
	Questionable Status Limit Register	Reset	**STAT:PRES** on page 493
		Reads conditional register value.	**STAT:QUES:LIM:COND?** on page 499
		Sets enable register value.	**STAT:QUES:LIM:ENAB** on page 500
		Reads event register value.	**STAT:QUES:LIM?** on page 499
		Sets positive transition filter value.	**STAT:QUES:LIM:PTR** on page 502
		Sets negative transition filter value.	**STAT:QUES:LIM:NTR** on page 501
	Questionable Status Search Register	Reset	**STAT:PRES** on page 493
		Reads conditional register value.	**STAT:QUES:SEAR:COND?** on page 505
		Sets enable register value.	**STAT:QUES:SEAR:ENAB** on page 505
		Reads event register value.	**STAT:QUES:SEAR?** on page 504
		Sets positive transition filter value.	**STAT:QUES:SEAR:PTR** on page 507
		Sets negative transition filter value.	**STAT:QUES:SEAR:NTR** on page 506
Beeper	Turns on/off the beep output		**SYST:BEEP:STAT** on page 516
	Produces a beep sound		**SYST:BEEP** on page 516
Internal clock	Date		**SYST:DATE** on page 517
	Time		**SYST:TIME** on page 524

Function	Item to be set or executed		GPIB command
Keyboard and Mouse	Enables/Disables front panel and keyboard operations.		**SYST:KLOC:KBD** on page 522 **SYST:KLOC** on page 522
	Enables/Disables mouse operations.		**SYST:KLOC:MOUS** on page 523
	Powers off E4991A		**SYST:POFF** on page 523
Product information	Reads manufacturer, model number, serial number, and firmware version.		***IDN?** on page 281
	Reads option number.		***OPT?** on page 282
	Reads SCPI version.		**SYST:VERS?** on page 524
Error message	Reads number of errors.		**SYST:ERR:COUN?** on page 518
	Reads error queue.		**SYST:ERR?** on page 517
Others	Command	Waits for execution.	***WAI** on page 284
		Returns 1 when completed.	***OPC?** on page 281
		Sets OPC bit when operation completes.	***OPC** on page 281
	Confirms whether external reference signal is inputted.		**SYST:EXTR?** on page 518
	Performs self-test and returns result.		***TST?** on page 284

GPIB Command List By Function

D Table of corresponding 4291B vs. E4991A GPIB commands

This appendix lists each Agilent E4991A GPIB command along with its corresponding Agilent 4291B GPIB command. Note that the simple commands prepared for the 4291B do not have equivalent E4991A commands.

Table of Corresponding GPIB Commands

ABORt:

4291B feature	4291B GPIB command	E4991A GPIB command
Reset the trigger system and place all trigger sequences in the idle state.	ABOR	**ABOR** on page 286

CALCulate subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Sets the partial search of the marker search function ON or OFF.	CALC:EVAL:BAND:FULL	**CALC{1-5}:MARK:FUNC:DOM** on page 312
Sets the partial search range to the range between the marker and the Δmarker.	CALC:EVAL:BAND:SPAN DMAR	**CALC{1-5}:MARK:FUNC:DOM:SPAN** on page 319
Sets the left (lower) border of the partial search range at the current position of the marker.	CALC:EVAL:BAND:STAR MARK	**CALC{1-5}:MARK:FUNC:DOM:STAR** on page 320
Sets the right (higher) border of the partial search range at the current position of the marker.	CALC:EVAL:BAND:STOP MARK	**CALC{1-5}:MARK:FUNC:DOM:STOP** on page 320
Sets the coupled or uncoupled marker mode.	CALC:EVAL:COUP	**CALC:MARK:COUP** on page 309
Selects the destination channel of the marker->functions. When a marker->function is performed, the sweep parameter or amplitude value of the destination channel is changed.	CALC:EVAL:EFF:ON	None (No concept of channel)
Calculates and display the equivalent circuit parameters.	CALC:EVAL:EPAR	**CALC{1-5}:EPAR** on page 295
Selects the equivalent circuit.	CALC:EVAL:EPAR:CIRC	**CALC{1-5}:EPAR:CIRC** on page 296
Sets the continuous or discontinuous marker mode.	CALC:EVAL:INT	**CALC{1-5}:MARK:DISC** on page 309
Queries the marker statistics.	CALC:EVAL:MST:DATA?	**CALC{1-5}:MST:DATA?** on page 344
Calculates the marker statistics in the portion of the displayed trace that is in the search range.	CALC:EVAL:MST	**CALC{1-5}:MST** on page 343
Displays the marker and selects the trace on which the marker functions are used.	CALC:EVAL:ON1 "TR{1-21}"	None (Among each of the GPIB commands, specifies the trace number that enables the marker function.)
Displays the voltage or current level applied to the DUT at the marker point.	CALC:EVAL:ON2	**CALC:BMON** on page 291 (However, only the DC bias level can be monitored.)
Sets the peak Δ value that is used to define the peak.	CALC:EVAL:PEAK:EXC	**CALC{1-5}:MARK:APE:EXC:Y** on page 308
Sets the peak Δ value to the difference of amplitude values between the preset marker position and both side display points of the marker.		**CALC{1-5}:MARK:APE:SET** on page 306
Sets the peak Δ value that is used to define the peak.	CALC:EVAL:PEAK:EXC:X	**CALC{1-5}:MARK:APE:EXC:X** on page 307
Sets the peak Δ value to the difference of stimulus values between the preset marker position and both side display points of the marker.		**CALC{1-5}:MARK:APE:SET** on page 306
Sets the peak polarity for the marker search functions.	CALC:EVAL:PEAK:POL	Chooses positive peak/negative peak in the following command. **CALC{1-5}:MARK:FUNC** on page 311
Sets the threshold values.	CALC:EVAL:PEAK:THR	None (Cannot set the threshold of the peak search function.)

4291B feature	4291B GPIB command	E4991A GPIB command
Sets the threshold ON or OFF.	CALC:EVAL:PEAK:THR:STAT	None (Cannot set the threshold of the peak search function.)
Selects a format to read out the value of a Smith, polar, or admittance chart using markers.	CALC:EVAL:R:FORM	**CALC{4-5}:MARK:FORM** on page 310
Returns the Δ marker value.	CALC:EVAL:REF:DATA?	Combines the following commands to execute. **CALC{1-5}:MARK:REF:X** on page 334 **CALC{1-5}:MARK:REF:Y** on page 335
Sets the stimulus value of the Δ marker.	CALC:EVAL:REF:X	**CALC{1-5}:MARK:REF:X** on page 334
Sets the amplitude value of the fixed Δ marker.	CALC:EVAL:REF:Y	**CALC{1-5}:MARK:REF:Y** on page 335
Sets the auxiliary amplitude value of the fixed Δ marker. This command is used with a polar, Smith, or admittance chart.	CALC:EVAL:REF:Y2	**CALC{1-5}:MARK:REF:Y** on page 335
Queries the bandwidth parameters.	CALC:EVAL:WIDT:DATA?	None (No concept of bandwidth function.)
Sets the bandwidth function ON or OFF.	CALC:EVAL:WIDT:STAT	
Searches for another bandwidth cutoff point that is within the current cutoff point.	CALC:EVAL:WIDT:XPOS:IN	
Searches for another bandwidth cutoff point that is outside of the current cutoff point.	CALC:EVAL:WIDT:XPOS:OUT	
Selects the bandwidth cutoff point value as shown in the parameter table.	CALC:EVAL:WIDT:Y	
Queries the measurement values and stimulus values at the marker position.(Query only)	CALC:EVAL:Y{1-8}:DATA?	Combines the following commands to execute. **CALC{1-5}:MARK{1-8}:X** on page 338 **CALC{1-5}:MARK{1-8}:Y?** on page 339
Queries the amplitude value at the marker position. (Query only)	CALC:EVAL:Y{1-8}:VAL{1|2}?	**CALC{1-5}:MARK{1-8}:Y?** on page 339
Sets a marker or sub-markers at the point of the stimulus when the marker is ON.	CALC:EVAL:Y{1-8}:XPOS	**CALC{1-5}:MARK{1-8}:X** on page 338
Moves the marker to the peak to the left of the present marker position.	CALC:EVAL:Y:XPOS:LPE	Combines the following commands to execute. **CALC{1-5}:MARK:FUNC** on page 311 **CALC{1-5}:MARK:FUNC:EXEC:LEFT** on page 322
Moves the marker to the next occurrence of the target value to the left of the present marker position.	CALC:EVAL:Y:XPOS:LTAR	
Moves the marker to the maximum point.	CALC:EVAL:Y:XPOS:MAX	**CALC{1-5}:MARK:FUNC:EXEC** on page 321
Moves the marker to the minimum point.	CALC:EVAL:Y:XPOS:MIN	
Moves the marker to the next peak.	CALC:EVAL:Y:XPOS:NPE	**CALC{1-5}:MARK:FUNC:EXEC:NEXT** on page 322
Moves the marker to the peak point.	CALC:EVAL:Y:XPOS:PEAK	**CALC{1-5}:MARK:FUNC:EXEC** on page 321
Moves the marker to the specified data point number.	CALC:EVAL:Y{1-8}:XPOS:POIN	None (Cannot move a marker by specifying a measurement point.)

4291B feature	4291B GPIB command	E4991A GPIB command
Moves the marker to the peak to the right of the present marker position.	CALC:EVAL:Y:XPOS:RPE	Combines the following commands to execute. **CALC{1-5}:MARK:FUNC** on page 311 **CALC{1-5}:MARK:FUNC:EXEC:RIGH** on page 323
Moves the marker to the next occurrence of the target value to the right of the present marker position.	CALC:EVAL:Y:XPOS:RTAR	
Sets the target value. The target search function moves the marker to a specific target point on the trace.	CALC:EVAL:Y:XPOS:TARG	**CALC{1-5}:MARK:FUNC:EXEC** on page 321
Sets the search tracking function.	CALC:EVAL:Y:XPOS:TRACK	**CALC{1-5}:MARK:FUNC:TRAC** on page 325
Sets the measurement parameter.	CALC:FORM	**CALC{1-5}:FORM** on page 298
Selects the unit of phase format.	CALC:FORM:UNIT:ANGL	**CALC{1-5}:FORM:UNIT:ANGL** on page 303
Turns the limit test beeper ON or OFF.	CALC:LIM:BEEP	None (Use the **SYST:BEEP** on page 516 command as necessary.)
Sets the limit test beeper.	CALC:LIM:COND	
Clears all segments in the limit line.	CALC:LIM:CLE	None
Adds or subtracts an offset from the stimulus values of the limit line.	CALC:LIM:CONT|:OFFS	None (Cannot add an offset to the limit.)
Displays limit lines.	CALC:LIM:LINE	None (Always indicated.)
Adds or subtracts an offset from the amplitude value of the limit line.	CALC:LIM:OFFS	None (Cannot add an offset to the limit.)
Completes editing the limit table.	CALC:LIM:SAVE	None (No need to declare.)
Specifies which limit segment in the table to edit.	CALC:LIM:SEGM	None (Specifies a marker number in the GPIB command used for creating a limit table.)
Adds a new segment to the end of the limit table.	CALC:LIM:SEGM:ADD	Sets a specified marker for a test marker using the following commands.) **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM** on page 313 **CALC{1-5}:MARK:REF:FUNC:DOM:LIM** on page 329
Sets the stimulus value of a segment.	CALC:LIM:SEGM:CONT	Moves the markers to a stimulus value specified by the following commands. **CALC{1-5}:MARK{1-8}:X** on page 338 **CALC{1-5}:MARK:REF:X** on page 334
Deletes a limit testing segment.	CALC:LIM:SEGM:DEL	Sets off the test marker using the following commands.) **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM** on page 313 **CALC{1-5}:MARK:REF:FUNC:DOM:LIM** on page 329
Sets the limits an equal amount above and below a specified middle value instead of setting upper and lower limits separately.	CALC:LIM:SEGM:DELTA	None (Cannot set the limit with the central value and delta value.)
Starts editing the segment.	CALC:LIM:SEGM:EDIT	None (No need to declare.)

4291B feature	4291B GPIB command	E4991A GPIB command
Sets the lower limit value for the segment.	CALC:LIM:SEGM:LOW	Sets using the following commands. **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:LOW** on page 316 **CALC{1-5}:MARK:REF:FUNC:DOM:LIM:LOW** on page 330
Sets the midpoint for delta limits.	CALC:LIM:SEGM:MIDD	None (Cannot set the limit with the central value and delta value.)
Terminates a limit segment definition.	CALC:LIM:SEGM:SAVE	None (No need to declare.)
Sets the upper limit value for a limit testing segment.	CALC:LIM:SEGM:UPP	Sets value with these commands: **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:UP** on page 318 **CALC{1-5}:MARK:REF:FUNC:DOM:LIM:UP** on page 332
Sets the limit testing ON or OFF.	CALC:LIM:STAT	**CALC{1-5}:MARK:FUNC:DOM:LIM:ALL** on page 314
Returns the available parameters that can be used with the CALC:MATH1:NAME command.	CALC:MATH1:CAT?	None
Sets the thickness of the dielectric material under test.	CALC:MATH1:DIM1	**CALC:FORM:PAR:DIE** on page 300
Sets the size of the toroidal core under test.	CALC:MATH1:DIM2	**CALC:FORM:PAR:MAG** on page 302
Sets the measurement parameter of the active channel, converting impedance to an admittance, permittivity, permeability or reflection coefficient.	CALC:MATH1:NAME	None (Can select a measurement parameter directly using **CALC{1-5}:FORM** on page 298.)
Sets the measurement parameter of the active channel, converting impedance to an admittance or reflection coefficient.	CALC:MATH1:STAT	
Returns the available parameters that can be used with the CALC:MATH2:NAME command.	CALC:MATH2:CAT?	None
Sets the data math operation.	CALC:MATH2:NAME	**CALC{1-5}:MATH:FUNC** on page 340 (Simultaneously performs the setting of the calculation function and the on/off switching. However, the data calculation function type differs from that of the 4291B.)
Sets data math function ON or OFF.	CALC:MATH2:STAT	

DATA subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Defines the following values: the auxiliary part of the offset value, the gain value of the data math function, the zooming aperture value as a percentage of the span.	DATA	None (No function to set the value.)
Defines the offset values.	DATA OFFS	**CALC{1-3}:MATH:OFFS** on page 342
Sets the marker's amplitude value into the offset value.		**CALC{1-5}:MARK:SET** on page 336
Sends the calibration coefficient arrays.	DATA CCO{11-33}	**DATA:CCO{1-6}** on page 346 In addition, it is possible to send/read the array for each segment if the following command is used. **DATA:SEGM{1-16}:CCO{1-6}** on page 351
Returns the calibration coefficient arrays.	DATA? CCO{11-33}	

Table of Corresponding GPIB Commands

4291B feature	4291B GPIB command	E4991A GPIB command
Sends the compensation coefficient arrays.	DATA CMP{1-3}	**DATA:CMP{1-3}** on page 348 In addition, it is possible to send/read the array for each segment if the following command is used. **DATA:SEGM{1-16}:CMP{1-3}** on page 353
Returns the compensation coefficient arrays.	DATA? CMP{1-3}	
Sends the data array.	DATA DATA	None (Cannot send/read a data array.)
Returns the data array.	DATA? DATA	
Sends the raw data array.	DATA RAW	None (Cannot send a raw data array.)
Returns the raw data array.	DATA? RAW	**DATA:RAW?** on page 349
Sends the fixture compensation open standard array.	DATA OADM	Combining and executing the following commands makes it possible to send/read the open standard array (G-B). **SENS:CORR2:CKIT:STAN1:LIST:B** on page 443 **SENS:CORR2:CKIT:STAN1:LIST:G** on page 444
Returns the fixture compensation open standard array.	DATA? OADM	
Sends the fixture compensation short standard array.	DATA SIMP	Combining and executing the following commands makes it possible to send/read out the short standard array (R-X). **SENS:CORR2:CKIT:STAN2:LIST:R** on page 446 **SENS:CORR2:CKIT:STAN2:LIST:X** on page 447
Returns the fixture compensation short standard array.	DATA? SIMP	
Sends the fixture compensation load standard array.	DATA LIMP	None (No concept of load compensation function.)
Returns the fixture compensation load standard array.	DATA? LIMP	
Sends the level monitor array.	DATA MON	None (cannot send)
Returns the level monitor array.	DATA? MON	**CALC:DATA:MON?** on page 292 (Only the DC bias monitor function is possible.)
Defines the specified equivalent circuit parameter.	DATA {EQC0|EQC1|EQL1|EQR1}	**CALC{1-5}:DATA:EPAR** on page 294

4291B feature	4291B GPIB command	E4991A GPIB command
Returns the limit test result of the fail points.	DATA? LFA	Combines the following commands in execution. **CALC{1-5}:MARK:REF:FUNC:DOM:LIM:RES?** on page 331 **CALC{1-5}:MARK:REF:X** on page 334 **CALC{1-5}:MARK:REF:FUNC:DOM:LIM:UP** on page 332 **CALC{1-5}:MARK:REF:FUNC:DOM:LIM:LOW** on page 330 **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:RES?** on page 317 **CALC{1-5}:MARK{1-8}:X** on page 338 **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:UP** on page 318 **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:LOW** on page 316
Returns the limit test result of all measurement points.	DATA? LLIS	**CALC{1-5}:MARK:FUNC:DOM:LIM:ALL:RES?** on page 315 (However, only returns the overall decision result of all test markers and cannot even read the test conditions.)
Returns the limit test result at the marker.	DATA? LMAR	Uses the following commands to read the marker position test result. However, the test conditions cannot be read. **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:RES?** on page 317 **CALC{1-5}:MARK:REF:FUNC:DOM:LIM:RES?** on page 331
Returns the selected memory array.	DATA? MEM	None
Returns the stimulus array (scalar).	DATA? SPAR	**SWE:STIM{1-4}?** on page 512
Returns the value at a specified point.	DATA:VAL?	None (Cannot specify a measurement point to read data.)
Sets the fixture compensation standard arrays.	DATA:DEF	Combines the following commands in execution. However, there is no load standard array. In addition, open standard is defined as G-B and short standard as R-X. **SENS:CORR2:CKIT:STAN1:LIST:B** on page 443 **SENS:CORR2:CKIT:STAN1:LIST:G** on page 444 **SENS:CORR2:CKIT:STAN2:LIST:R** on page 446 **SENS:CORR2:CKIT:STAN2:LIST:X** on page 447
Clears the fixture compensation standard array.	DATA:DEL	None

4291B feature	4291B GPIB command	E4991A GPIB command
Returns the number of the limit test fail points.	DATA:POIN? LFA	None However, it is possible to specify a marker to read pass/fail by using the following commands. **CALC{1-5}:MARK{1-8}:FUNC:DOM:LIM:RES?** on page 317 **CALC{1-5}:MARK:REF:FUNC:DOM:LIM:RES?** on page 331

DIAGnostics subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Queries whether the external reference signal is connected to the external reference input on the rear panel.	DIAG:EREF:STAT?	**SYST:EXTR?** on page 518
Returns the model number and the firmware version.	DIAG:FREV?	***IDN?** on page 281
Returns the power-on test result.	DIAG:INIT:RES?	None

DISPlay subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Blanks the frequency notation for security purposes.	DISP:ANN:FREQ	None
Sets backlighting of the LCD ON or OFF.	DISP:BACK	**DISP:BACK** on page 354
Sets the display intensity as a percent of the brightest setting.	DISP:BRIG	None
Resets the color being modified to the default color.	DISP:CMP:COL:DEF	
Changes color of the display element.	DISP:CMP:CLO{1-14}:HSL	
Sets all the color settings back to the default values.	DISP:CMP:DEF	
Recalls the previously saved color settings from the non-volatile memory.	DISP:CMP:LOAD	
Saves the current color setting to the non-volatile memory.	DISP:CMP:STOR	
Sets the background intensity of the display as a percent of the white level.	DISP:CONT	
Selects the display allocation mode.	DISP:ALL	None (Split display of the measurement display and macro display is not possible.)
Sets the full-screen or split display when in the dual channel mode.	DISP:FORM	None (No concept of channel.) However, when a scalar trace is displayed, it is possible to switch between split windows and overlay windows using the following command. **DISP:FORM** on page 355
Sets the I-BASIC graphic function ON or OFF.	DISP:GRAP:STAT	None (I-BASIC not loaded)
Erases all labels.	DISP:TEXT{11-30}:CLE	None (Cannot delete all trace titles at once.)
Selects the color of the specified label.	DISP:TEXT{11-30}:COL	None

4291B feature	4291B GPIB command	E4991A GPIB command
Sets the string to the following display area.	DISP:TEXT{10-38}	Combines the following commands in execution. **DISP:TRAC{1-5}:TITL:DATA** on page 361 **DISP:TRAC{1-5}:TITL** on page 360
Defines where the specified label appears.	DISP:TEXT{11-30}:LOC	None (Display area of trace title is fixed.)
Selects a page of a tabular list.	DISP:TEXT{1-8}:PAGE	**DISP:TEXT{1-3}:SET** on page 356
Displays a tabular list.	DISP:TEXT{1-9|39|40}:STAT	Displays each list using the following commands. **CALC{1-5}:MARK:LIST** on page 326 **DISP:TEXT{1-3}:SET** on page 356
Clears memory traces or user traces.	DISP:TRAC{2-21}:CLE	None (Cannot delete the traces at once.)
Sets the four user traces axis to coupled or uncoupled.	DISP:TRAC{18-21}:GRAT:AXIS:COUP	None (No concept of user trace.)
Selects the display format.	DISP:TRAC1:GRAT:FORM	**DISP:TRAC{1-5}:GRAT:FORM** on page 357
Sets the grid on the display of the selected channel ON or OFF.	DISP:TRAC{1-21}:GRAT:GRID	None (Cannot switch the on/off of the grid display.)
Turns off all markers and cancels all settings of the marker functions.	DISP:TRAC{1-21}:MARK:ALL DEF	**CALC{1-5}:MARK:AOFF** on page 305
Turns the marker ON or OFF.	DISP:TRAC{1-21}:MARK:ALL:STAT	Uses the following commands to turn on/off the marker. **CALC{1-5}:MARK{1-8}** on page 304 **CALC{1-5}:MARK:REF** on page 328
Displays the Δ marker at the point of the marker and the marker mode changes to the Δ mode.	DISP:TRAC{1-21}:MARK:REL	Combines the following commands to execute. **CALC{1-5}:MARK:REF** on page 328 **CALC{1-5}:MARK:REF:TYPE** on page 333
Changes the marker mode to the fixed or tracking Δ mode.	DISP:TRAC{1-21}:MARK:REL:REF	
Displays specified sub-marker at the point of the marker (ON).	DISP:TRAC{1-21}:MARK{2-8}:STAT	None (No concept of sub-marker.)
Selects the marker X-axis unit.	DISP:TRAC{1-21}:MARK{1-8}:UNIT	**CALC{1-5}:MARK:UNIT** on page 337
Selects the trace to be displayed.	DISP:TRAC{1-21}:STAT	**CALC{1-5}:MATH:FUNC** on page 340
Defines the left edge value of the X-axis of the graticule for the user trace.	DISP:TRAC{1-21}:X:LEFT	None (No concept of user trace.)
Defines the right edge value of the X-axis of the graticule for the user trace.	DISP:TRAC{1-21}:X:RIGH	
Sets the value of the X-axis reference when the measurement format is set to the complex plane.	DISP:TRAC{1-21}:X:RLEV	**DISP:TRAC{4-5}:X:RLEV** on page 362
Selects the sweep type of Data&Memory trace, LINear or LOGarithmic. Selects the scale of the user trace, LINear or LOGarithmic. Selects the order base on frequency base list sweep.	DISP:TRAC{1-21}:X:SPAC	**DISP:TRAC{1-5}:X:SPAC** on page 363
Defines the X-axis unit of the graticule for the user trace.	DISP:TRAC{1-21}:X:UNIT	None (No concept of user trace.)
Adjusts the display scale and brings the trace data, defined by the TRACe{1-21} node, into view on the display.	DISP:TRAC{1-21}:Y:AUTO ONCE	**DISP:TRAC{1-5}:Y:AUTO** on page 364

4291B feature	4291B GPIB command	E4991A GPIB command
Defines the bottom border of the display and adjusts the scale value.	DISP:TRAC{1-21}:Y:BOTT	**DISP:TRAC{1-3}:Y:BOTT** on page 365
Couples or uncouples the DATA and MEMORY traces to be scaled.	DISP:TRAC{1-21}:Y:COUP	**DISP:TRAC{1-5}:Y:FOR** on page 366
Sets the response value scale per graticule trace.	DISP:TRAC{1-21}:Y:PDIV	None (Cannot set a scale using a scale ratio.)
Sets the value of the reference line.	DISP:TRAC{1-21}:Y:RLEV	**DISP:TRAC{1-5}:Y:RLEV** on page 369
Sets the position of the reference line on the graticule of a Cartesian display.	DISP:TRAC{1-21}:Y:RPOS	**DISP:TRAC{1-3}:Y:RPOS** on page 370
Defines the top border of the display and adjusts the scale value.	DISP:TRAC{1-21}:Y:TOP	**DISP:TRAC{1-3}:Y:TOP** on page 372
Sets the Y-axis to LINear or LOGarithmic.	DISP:TRAC{1-21}:Y:SPAC	**DISP:TRAC{1-3}:Y:SPAC** on page 371
Defines the Y-axis unit of the graticule for the user trace.	DISP:TRAC{1-21}:Y:UNIT	None (No concept of user trace.)

FORMat subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Sets the format to transfer data via GPIB.	FORM	**FORM:DATA** on page 374

HCOPy subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Aborts print in progress.	HCOP:ABOR	**HCOP:ABOR** on page 380
Sets the printing parameters to their default values.	HCOP:DEF	None
Sets the default colors or the colors as close as possible to the display colors for printing a hard copy.	HCOP:DEV:CMAP:COL	**HCOP:IMAG** on page 381
Sets the print command to color printing.	HCOP:DEV:COL	**HCOP:IMAG** on page 381
Specifies the resolution of a printer used for printing by dpi.	HCOP:DEV:DPI	None (Set with the printer driver.)
Sets the printer ON or OFF for delivering printed paper each time printing an entire screen is finished.	HCOP:DEV:FORMF	None (Paper feed will be performed.)
Sets the orientation of paper to landscape or not using ON or OFF.	HCOP:DEV:LAND	None (Set with the printer driver.)
Specifies the left margin of printing by inch.	HCOP:DEV:LEFTM	
Sets printing of the softkeys displayed on the screen ON or OFF.	HCOP:DEV:SKEY	
Specifies the top margin of printing in inches.	HCOP:DEV:TOPM	
Executes printing.	HCOP	**HCOP** on page 380
Turns printing time and date (the time stamp function) ON or OFF.	HCOP:ITEM:TDST:STAT	None

INITiate subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Initiates the trigger system continuously.	INIT:CONT	**INIT:CONT** on page 382
Initiates trigger system.	INIT	**INIT** on page 382
Aborts the sweep in progress to exit to the idle state and initiates the trigger system again.	INIT:AGAL:ALL	None

INSTrument subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Selects the active channel.	INST {CH1|CH2}	None (No concept of channel.) With the E4991A, uses the following command when the trace is set to active trace. **DISP:TRAC{1-5}:SEL** on page 358
Sets the channel coupling of stimulus values.	INST:COUP	None (No concept of channel.)
Selects the active channel.	INST:NSEL	None (No concept of channel.) With the E4991A, uses the following command to set the trace to active trace. **DISP:TRAC{1-5}:SEL** on page 358
Displays the selected channel.	INST:STAT	None (No concept of channel.) With the E4991A, uses the following command to display the selected trace. **DISP:TRAC{1-5}** on page 356

MMEMory subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Changes the current directory of a DOS formatted disk.	MMEM:CDIR	**MMEM:CDIR** on page 383
Copies files.	MMEM:COPY	**MMEM:COPY** on page 384
Creates a new directory in a DOS formatted disk.	MMEM:CRE:DIR	**MMEM:MDIR** on page 386
Removes the files.	MMEM:DEL	**MMEM:DEL** on page 384
Initialize the disk in floppy disk drive or memory disk.	MMEM:INIT	None (Cannot format a floppy disk. In addition, a memory disk is not loaded.)
Loads the instrument states.	MMEM:LOAD:STAT	**MMEM:LOAD** on page 385
Loads data.	MMEM:LOAD:TRAC	**MMEM:LOAD:TRAC** on page 386
Saves the graphic image on the screen as a TIFF file.	MMEM:STOR:DINT:TIFF	Uses the following commands. However, it cannot save in TIFF format but only in JPEG/BMP format. **MMEM:STOR:GRAP** on page 389 **MMEM:STOR:GRAP:BMP** on page 390
Saves data arrays as an ASCII file.	MMEM:STOR:DINT:TRAC	**MMEM:STOR:TRAC:ASC** on page 391
Returns information on the current states of the data arrays that are saved.	MMEM:STOR:ITEM:TRAC:CAT?	None
Selects the items that are not to be saved.	MMEM:STOR:ITEM:TRAC:DEL	**MMEM:STOR:TRAC:SEL{1-4}** on page 392
Selects the items to be saved.	MMEM:STOR:ITEM:TRAC:SEL	
Saves only the instrument states and the calibration coefficients.	MMEM:STOR:STAT	The following command is used, but data other than the equipment condition and calibration coefficient will also be saved together. **MMEM:STOR** on page 388

4291B feature	4291B GPIB command	E4991A GPIB command
Save data arrays that are defined by the MMEMory:STORe:ITEM:TRACe subsystem commands.	MMEM:STOR:TRAC	Uses the following format to save in a specified data format. **MMEM:STOR:TRAC** on page 391 **MMEM:STOR:TRAC:ASC** on page 391

PROGram subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Returns the defined program name.	PROG:CAT?	The E4991A has a macro function (E4991A VBA) instead of Instrument BASIC. **PROG:CAT?** on page 394
Creates and downloads program from an external controller to Instrument BASIC.	PROG:DEF	None
Deletes I-BASIC program in the analyzer.	PROG:DEL	
Deletes all I-BASIC program in the analyzer.	PROG:DEL:ALL	
Executes the program command.	PROG:EXEC	
Performs no practical function for the analyzer.	PROG:MALL	
Define the program name.	PROG:NAME	**PROG:NAME** on page 394
Sets or queries the contents of numeric program variables and arrays in the I-BASIC of the analyzer.	PROG:NUMB	None
Sets or queries the state of the program in the analyzer.	PROG:STAT	**PROG:STAT** on page 395
Sets or queries the contents of the string program variables and array of the I-BASIC of the analyzer.	PROG:STR	None
Causes no further commands or queries to be executed until the program in the analyzer exits from the RUN state.	PROG:WAIT	**PROG:WAIT** on page 395
Creates and downloads program from an external controller to Instrument BASIC.	PROG:EXPL:DEF	None
Deletes I-BASIC program in the analyzer.	PROG:EXPL:DEL	
Executes the program command.	PROG:EXPL:EXEC	
Performs no practical function for the analyzer.	PROG:EXPL:MALL	
Define the program name.	PROG:EXPL:NAME	
Sets or queries the contents of numeric program variables and arrays in the I-BASIC of the analyzer.	PROG:EXPL:NUMB	
Sets or queries the state of the program in the analyzer.	PROG:EXPL:STAT	
Sets or queries the contents of the string program variables and array of the I-BASIC of the analyzer.	PROG:EXPL:STR	
Causes no further commands or queries to be executed until the program in the analyzer exits from the RUN state.	PROG:EXPL:WAIT	

SENSe subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Sets the point averaging factor for the active channel.	SENS:AVER1:COUN	**AVER:COUN** on page 288
Sets the point averaging of the active channel ON or OFF.	SENS:AVER1	**AVER** on page 287
Resets the averaging and restarts the sweep count at 1 at the beginning of the next sweep on the active channel.	SENS:AVER2:CLE	**CALC:AVER:CLE** on page 289

4291B feature	4291B GPIB command	E4991A GPIB command
Sets the sweep averaging factor for the active channel.	SENS:AVER2:COUN	**CALC:AVER:COUN** on page 290
Turns the sweep averaging factor ON or OFF for the active channel.	SENS:AVER2	**CALC:AVER** on page 289
Sets the calibration kit.	SENS:CORR1:CKIT	**SENS:CORR1:CKIT** on page 420
Defines a label of the user-modified calibration kit.	SENS:CORR1:CKIT:LAB	None
Stores the user-modified calibration kit into memory.	SENS:CORR1:CKIT:SAVE	None (However, can save a defined value in the user-defined calibration kit in the state file.)
Enters the capacitance value of the OPEN standard that is used in the user-modified calibration kit.	SENS:CORR1:CKIT:STAN1:C	**SENS:CORR1:CKIT:STAN1:C** on page 422
Enters the conductance value of the OPEN standard that is used in the user-modified calibration kit.	SENS:CORR1:CKIT:STAN1:G	**SENS:CORR1:CKIT:STAN1:G** on page 423
Enters the inductance value of the SHORT standard that is used in the user-modified calibration kit.	SENS:CORR1:CKIT:STAN2:L	**SENS:CORR1:CKIT:STAN2:L** on page 426
Enters the resistance value of the SHORT standard that is used in the user-modified calibration kit.	SENS:CORR1:CKIT:STAN2:R	**SENS:CORR1:CKIT:STAN2:R** on page 429
Enters the resistance value of the LOAD standard that is used in the user-modified calibration kit.	SENS:CORR1:CKIT:STAN3:R	**SENS:CORR1:CKIT:STAN3:R** on page 433
Enters the reactance value of the LOAD standard that is used in the user-modified calibration kit.	SENS:CORR1:CKIT:STAN3:X	**SENS:CORR1:CKIT:STAN3:L** on page 430 (However, uses a reactance value for setting.)
Selects and acquires the calibration.	SENS:CORR1:COLL	**SENS:CORR1:COLL** on page 437
Selects the frequency points where the calibration data is collected.	SENS:CORR1:COLL:FPO	**SENS:CORR1:COLL:FPO** on page 438
Calculates the error-correction coefficients from the calibration data and stores the coefficients.	SENS:CORR1:COLL:SAVE	**SENS:CORR1:COLL:SAVE** on page 439
Sets the port extension ON or OFF.	SENS:CORR1:EDEL:STAT	Uses the following command to set the off-set delay time, except for the test fixture electrical length, and at the same time sets ON the compensation function. **SENS:CORR2:EDEL:TIME** on page 453
Sets the port extension value.	SENS:CORR1:EDEL	
Queries to determine if the correction state is ON or OFF.	SENS:CORR1?	**SENS:CORR1** on page 419
Defines the label for the user-modified compensation kit.	SENS:CORR2:CKIT:LAB	None
Stores the user-modified compensation kit into memory.	SENS:CORR2:CKIT:SAVE	None (However, can save the standard value for the fixture compensation in a state file.)
Enters the capacitance value of the OPEN standard that is used in OPEN compensation.	SENS:CORR2:CKIT:STAN1:C	**SENS:CORR2:CKIT:STAN1:C** on page 441
Enters the conductance value of the OPEN standard that is used in OPEN compensation.	SENS:CORR2:CKIT:STAN1:G	**SENS:CORR2:CKIT:STAN1:G** on page 442
Selects the fixture compensation open standard.	SENS:CORR2:CKIT:STAN1	**SENS:CORR2:CKIT:LIST** on page 440 (However, cannot choose open/short alone.)
Enters the inductance value of the SHORT standard that is used in SHORT compensation.	SENS:CORR2:CKIT:STAN2:L	**SENS:CORR2:CKIT:STAN2:L** on page 445
Enters the resistance value of the SHORT standard that is used in SHORT compensation.	SENS:CORR2:CKIT:STAN2:R	**SENS:CORR2:CKIT:STAN2:R** on page 448

Table of Corresponding GPIB Commands

4291B feature	4291B GPIB command	E4991A GPIB command
Selects the fixture compensation short standard.	SENS:CORR2:CKIT:STAN2	**SENS:CORR2:CKIT:LIST** on page 440 (However, cannot choose open/short alone.)
Enters the inductance value of the LOAD standard that is used in LOAD compensation.	SENS:CORR2:CKIT:STAN3:L	None (No concept of the load compensation function.)
Enters the resistance value of the LOAD standard that is used in LOAD compensation.	SENS:CORR2:CKIT:STAN3:R	
Selects the fixture compensation load standard.	SENS:CORR2:CKIT:STAN3	
Selects the load standard used for the dielectric material test fixture compensation.	SENS:CORR2:CKIT2	The following command is used to choose a calibration kit in a dielectric material measurement. **SENS:CORR1:CKIT** on page 420
Defines the label of the user-modified compensation kit for the permittivity measurement.	SENS:CORR2:CKIT2:LAB	None
Stores the user-modified compensation kit for the permittivity measurement into memory.	SENS:CORR2:CKIT2:SAVE	None (However, can save a user-defined load standard value in the state file.)
Enters the relative permittivity value of the LOAD standard that is used in LOAD compensation for the permittivity measurement.	SENS:CORR2:CKIT2:STAN6:PRE	**SENS:CORR1:CKIT:STAN7:PRE** on page 435
Enters the relative dielectric loss index value of user-modified LOAD standard that is used in LOAD compensation for the permittivity measurement.	SENS:CORR2:CKIT2:STAN6:PLF	**SENS:CORR1:CKIT:STAN7:PLF** on page 434
Enters the thickness value of user-modified LOAD standard that is used in LOAD compensation for the permittivity measurement.	SENS:CORR2:CKIT2:STAN6:THIC	**SENS:CORR1:CKIT:STAN7:THIC** on page 436
Measures the standard for the fixture compensation.	SENS:CORR2:COLL	**SENS:CORR2:COLL** on page 449
Selects the frequency points where the correction data is corrected.	SENS:CORR2:COLL:FPO	**SENS:CORR2:COLL:FPO** on page 450
Calculates the fixture compensation coefficients and stores the coefficients.	SENS:CORR2:COLL:SAVE	**SENS:CORR2:COLL:SAVE** on page 451
Sets the OPEN fixture compensation ON or OFF.	SENS:CORR2:OPEN	**SENS:CORR2:COLL:OPEN** on page 451
Sets the SHORT fixture compensation ON or OFF.	SENS:CORR2:SHOR	**SENS:CORR2:COLL:SHOR** on page 452
Sets the LOAD fixture compensation ON or OFF.	SENS:CORR2:LOAD	None (No concept of the load compensation function.)
Defines the center frequency value of the stimulus range.	SENS:FREQ:CENT	**FREQ:CENT** on page 376
Sets the frequency center value to the difference value between the marker and the delta marker values.		None
Sets the frequency center value of the marker.		**CALC{1-5}:MARK:SET** on page 336
Searches for a peak using the marker and then changes the CENTER to the frequency value of that peak.		Combines the following commands in execution. **CALC{1-5}:MARK:FUNC:EXEC** on page 321 **CALC{1-5}:MARK:SET** on page 336
Selects the sweep type.	SENS:FREQ:MODE	**SWE:TYPE** on page 515

4291B feature	4291B GPIB command	E4991A GPIB command
Sets the frequency span.	SENS:FREQ:SPAN	**FREQ:SPAN** on page 377
Sets the frequency span value of the difference between the marker and the delta marker values.		**CALC{1-5}:MARK:SET** on page 336
Sets the frequency span value of the "frequency span × zooming aperture".		None (No zooming function for sweep span.)
Sets the start frequency value.	SENS:FREQ:STAR	**FREQ:STAR** on page 378
Sets the start frequency value of the sweep parameter value of the marker.		**CALC{1-5}:MARK:SET** on page 336
Sets the stop frequency value.	SENS:FREQ:STOP	**FREQ:STOP** on page 379
Sets the stop frequency value of the sweep parameter value of the marker.		**CALC{1-5}:MARK:SET** on page 336
Clears the entire list.	SENS:LIST:CLE	**SEGM:DEL:ALL** on page 406
Completes editing the frequency sweep list.	SENS:LIST:SAVE	None (No need to declare.)
Selects the segment to edit.	SENS:LIST:SEGM	None (Specifies a segment number in the GPIB command for the segment to edit.)
Adds a new segment to a list sweep table.	SENS:LIST:SEGM:ADD	None (**SEGM:COUN** on page 397 command is used to clear a table and add a new segment.)
Sets the point averaging factor for the list sweep table.	SENS:LIST:SEGM:AVER:COUN	**SEGM{1-16}:AVER:COUN** on page 396
Sets the OSC level for the list sweep table to Ampere.	SENS:LIST:SEGM:CURR	**SEGM{1-16}:CURR** on page 398
Deletes the segments.	SENS:LIST:SEGM:DEL	None (Only a method to delete all the segments at once is available.)
Edits the segments.	SENS:LIST:SEGM:EDIT	None (However, it is necessary to create a segment in the segment sweep table using the following command before editing the segment.) **SEGM:COUN** on page 397
Sets to center the frequency value of the segment in the list sweep table.	SENS:LIST:SEGM:FREQ:CENT	**SEGM{1-16}:FREQ:CENT** on page 407
Sets the frequency span of the segment.	SENS:LIST:SEGM:FREQ:SPAN	**SEGM{1-16}:FREQ:SPAN** on page 408
Sets the start frequency value of the segment in the list sweep table.	SENS:LIST:SEGM:FREQ:STAR	**SEGM{1-16}:FREQ:STAR** on page 409
Sets the start frequency value of the sweep parameter value of the marker.		None
Sets the stop frequency value of the segment in the list sweep table.	SENS:LIST:SEGM:FREQ:STOP	**SEGM{1-16}:FREQ:STOP** on page 410
Sets the stop frequency value of the sweep parameter value of the marker.		None
Sets the number of points for the segment for the list sweep table.	SENS:LIST:SEGM:POIN	**SEGM{1-16}:SWE:POIN** on page 413
Sets the OSC level for the list sweep table to dBm.	SENS:LIST:SEGM:POW	**SEGM{1-16}:POW** on page 411
Quits editing a segment of the list sweep table.	SENS:LIST:SEGM:QUIT	None (No need to declare.)
Completes modifying a segment in a list sweep table.	SENS:LIST:SEGM:SAVE	
Sets the OSC level for a list sweep table with the unit of Volt.	SENS:LIST:SEGM:VOLT	**SEGM{1-16}:VOLT** on page 414
Defines number of sweeps.	SENS:SWE:COUN	None (However, if the sweep averaging function is on, one trigger will perform a sweep of the specified number of averagings.)
Defines point delay times.	SENS:SWE:DWEL1	**SWE:DWEL2** on page 509

4291B feature	4291B GPIB command	E4991A GPIB command
Defines the sweep delay times.	SENS:SWE:DWEL2	**SWE:DWEL1** on page 508
Sets the automatic or manual point delay time.	SENS:SWE:DWEL1:AUTO	None (Delay value = 0 seconds corresponds to the automatic setting for the 4291B.)
Sets the automatic or manual sweep delay time.	SENS:SWE:DWEL2:AUTO	
Sets number of points	SENS:SWE:POIN	**SWE:POIN** on page 511
Selects the sweep type.	SENS:SWE:SPAC	**SWE:TYPE** on page 515 (However, it is necessary to choose a sweep type in combination with the sweep parameter.)
Sets the sweep time.	SENS:SWE:TIME	**SWE:TIME** on page 513
Sets the automatic or manual sweep time.	SENS:SWE:TIME:AUTO	**SWE:TIME:AUTO** on page 514

SOURce subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Sets the frequency.	SOUR1:FREQ	**FREQ** on page 375
Sets the OSC current level for a frequency sweep.	SOUR1:CURR	**SOUR:CURR** on page 457
Sets the OSC power level for a frequency sweep.	SOUR1:POW	**SOUR:POW** on page 470
Selects a sweep direction of UP or DOWN when in the OSC level sweep mode.	SOUR1:SWE:DIR	**SWE:DIR** on page 508
Selects the sweep type in the OSC level sweep.	SOUR1:SWE:SPAC	None (The sweep type is fixed to the linear sweep for the oscillator level sweep.)
Sets the OSC voltage level sweep center value.	SOUR1:VOLT:CENT	**SOUR:VOLT:CENT** on page 477
Sets the OSC voltage level sweep center value to the difference between the marker and the delta marker values.		None
Sets the OSC voltage level sweep center value of the marker.		**CALC{1-5}:MARK:SET** on page 336
Search for a peak using the marker and then changes the CENTER to the OSC voltage level sweep value of that peak.		The following commands are combined in execution. **CALC{1-5}:MARK:FUNC:EXEC** on page 321 **CALC{1-5}:MARK:SET** on page 336
Sets the OSC voltage level for frequency/DC-I/DC-V sweep.	SOUR1:VOLT	**SOUR:VOLT** on page 476
Selects the sweep source.	SOUR1:VOLT:MODE	None (uses **SWE:TYPE** on page 515 to set the sweep parameter.)
Sets the OSC voltage level sweep span value.	SOUR1:VOLT:SPAN	**SOUR:VOLT:SPAN** on page 486
Sets the OSC voltage level sweep span value to the difference value between the marker and the delta marker values.		**CALC{1-5}:MARK:SET** on page 336
Sets the OSC voltage level sweep span value of the "OSC level span × zooming aperture".		None (No zooming function for sweep span.)
Sets the OSC voltage level sweep start value.	SOUR1:VOLT:STAR	**SOUR:VOLT:STAR** on page 487
Sets the OSC voltage level sweep start value of the marker.		**CALC{1-5}:MARK:SET** on page 336
Sets the OSC voltage level sweep stop value.	SOUR1:VOLT:STOP	**SOUR:VOLT:STOP** on page 488
Sets the OSC voltage level sweep stop value of the marker.		**CALC{1-5}:MARK:SET** on page 336

4291B feature	4291B GPIB command	E4991A GPIB command
Sets dc bias mode to the current setting mode.	SOUR2:CURR:ALC	None (Uses **SWE:TYPE** on page 515 to set the sweep parameter at DC bias current sweep. In addition, uses **SEGM:CURR:OFFS:STAT** on page 399 for segment sweep when setting the fixed current source mode and **SOUR:CURR:OFFS:STAT** on page 465 for settings other than the segment sweep.)
Sets the dc bias sweep current center value.	SOUR2:CURR:CENT	**SOUR:CURR:OFFS:CENT** on page 462
Sets the OSC current level sweep center value to the difference between the marker and the delta marker values.		None
Sets the OSC current level sweep center value of the marker.		**CALC{1-5}:MARK:SET** on page 336
Searches for a peak using the marker and then changes the CENTER to the OSC current level sweep value of that peak.		Combines the following commands in execution. **CALC{1-5}:MARK:FUNC:EXEC** on page 321 **CALC{1-5}:MARK:SET** on page 336
Sets dc bias current value.	SOUR2:CURR	**SOUR:CURR:OFFS** on page 461
Sets the current limit in the dc bias sweep mode.	SOUR2:CURR:LIM	**SOUR:CURR:LIM:OFFS** on page 459
Selects the sweep source.	SOUR2:CURR:MODE	None (Uses **SWE:TYPE** on page 515 command to set the sweep parameter.)
Sets the OSC current level sweep span value.	SOUR2:CURR:SPAN	**SOUR:CURR:OFFS:SPAN** on page 463
Sets the OSC current level sweep span value to the difference between the marker and the delta marker values.		**CALC{1-5}:MARK:SET** on page 336
Sets the OSC current level sweep span value of the "OSC level span × zooming aperture".		None (No zooming function for the sweep span.)
Sets the OSC current level sweep start value.	SOUR2:CURR:STAR	**SOUR:CURR:OFFS:STAR** on page 464
Sets the OSC current level sweep start value of the marker.		**CALC{1-5}:MARK:SET** on page 336
Sets the dc bias output ON or OFF.	SOUR2:CURR:STAT	**SOUR:CURR:OFFS:STAT** on page 465
Sets the OSC current level sweep stop value.	SOUR2:CURR:STOP	**SOUR:CURR:OFFS:STOP** on page 466
Sets the OSC current level sweep stop value of the marker.		**CALC{1-5}:MARK:SET** on page 336
Sets dc bias mode to the voltage setting mode.	SOUR2:VOLT:ALC	None (Usec **SWE:TYPE** on page 515 to set the sweep parameter at the DC bias voltage sweep. In addition, uses **SEGM:VOLT:OFFS:STAT** on page 417 for the segment sweep when setting at the fixed voltage source mode and **SOUR:VOLT:OFFS:STAT** on page 484 for settings other than the segment sweep.)

4291B feature	4291B GPIB command	E4991A GPIB command
Sets the dc bias sweep voltage center value.	SOUR2:VOLT:CENT	**SOUR:VOLT:OFFS:CENT** on page 481
Sets the OSC voltage level sweep center value to the difference between the marker and the delta marker values.		**CALC{1-5}:MARK:SET** on page 336
Sets the OSC voltage level sweep center value of the marker.		None
Searches for a peak using the marker and then changes the CENTER to the OSC voltage level sweep value of that peak.		Combines the following commands in execution. **CALC{1-5}:MARK:FUNC:EXEC** on page 321 **CALC{1-5}:MARK:SET** on page 336
Sets dc bias voltage value.	SOUR2:VOLT	**SOUR:VOLT:OFFS** command on page 480
Sets the voltage limit in the dc bias sweep mode.	SOUR2:VOLT:LIM	**SOUR:VOLT:LIM:OFFS** on page 478
Selects the sweep source.	SOUR2:VOLT:MODE	None (Uses the **SWE:TYPE** on page 515 command to set the sweep parameter.)
Sets the OSC voltage level sweep span value.	SOUR2:VOLT:SPAN	**SOUR:VOLT:OFFS:SPAN** on page 482
Sets the OSC voltage level sweep span value to the difference between the marker and the delta marker values.		**CALC{1-5}:MARK:SET** on page 336
Sets the OSC voltage level sweep span value of the "OSC level span × zooming aperture".		None (No zooming function for the sweep span.)
Sets the OSC voltage level sweep start value.	SOUR2:VOLT:STAR	**SOUR:VOLT:OFFS:STAR** on page 483
Sets the OSC voltage level sweep start value of the marker.		**CALC{1-5}:MARK:SET** on page 336
Sets the dc bias output ON or OFF.	SOUR2:VOLT:STAT	**SOUR:VOLT:OFFS:STAT** on page 484
Sets the OSC voltage level sweep stop value.	SOUR2:VOLT:STOP	**SOUR:VOLT:OFFS:STOP** on page 485
Sets the OSC voltage level sweep stop value of the marker.		**CALC{1-5}:MARK:SET** on page 336
Selects the sweep direction when in the dc bias sweep mode.	SOUR2:SWE:DIR	**SWE:DIR** on page 508
Selects the sweep type in dc bias sweep.	SOUR2:SWE:SPAC	None (The sweep type for the dc bias sweep is fixed to a linear sweep.)

STATus subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Sets the contents of the Instrument Event Status Enable Register.	STAT:INST:ENAB	None (No instrument event status effective register.)
Returns the contents of the Instrument Event Status Register.	STAT:INST?	
Queries the contents of Operation Status Condition Register.	STAT:OPER:COND?	**STAT:OPER:COND?** on page 489
Sets the contents of the Operation Status Enable Register.	STAT:OPER:ENAB	**STAT:OPER:ENAB** on page 490
Queries the contents of the Operation Status Event Register.	STAT:OPER?	**STAT:OPER?** on page 489

4291B feature	4291B GPIB command	E4991A GPIB command
Sets the negative transition filter of the Operation Status Register.	STAT:OPER:NTR	**STAT:OPER:NTR** on page 491
Sets the positive transition filter of the Operation Status Register.	STAT:OPER:PTR	**STAT:OPER:PTR** on page 492
Presets the Operation and Questionable Status Enable Registers and transition filters.	STAT:PRES	**STAT:PRES** on page 493
Queries the contents of the Questionable Status Condition Register.	STAT:QUES:COND?	**STAT:QUES:COND?** on page 493
Sets the value of the Questionable Status Enable Register.	STAT:QUES:ENAB	**STAT:QUES:ENAB** on page 494
Queries the contents of the Questionable Event Status Register.	STAT:QUES?	**STAT:QUES?** on page 493

SYSTem subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Sets an annunciator that sounds to indicate completion of a certain operation.	SYST:BEEP1:STAT	**SYST:BEEP:STAT** on page 516
Sets an annunciator that sounds as a warning.	SYST:BEEP2:STAT	
Sets the GPIB address that the analyzer will use to communicate with the external controller.	SYST:COMM:GPIB:CONT:ADDR	None
Reads data from 4-bit parallel input of the analyzer.	SYST:COMM:PAR:DATA?	None (Parallel I/O not loaded.)
Outputs data to the 8-bit parallel output port.	SYST:COMM:PAR:TRAN:DATA	
Sets the date of the internal clock.	SYST:DATE	**SYST:DATE** on page 517
Changes the displayed date.	SYST:DATE:MODE	None
Outputs the error message in the error queue.	SYST:ERR?	**SYST:ERR?** on page 517
Specifies the fixture in use in order to select which electrical length is to be used.	SYST:FIXT	**SENS:CORR2:FIXT** on page 454
Sets the electrical length of the user-modified fixture.	SYST:FIXT:DIST	**SENS:CORR2:FIXT:EDEL:USER:DIST** on page 456
Modifies the label of the user-modified fixture.	SYST:FIXT:LAB	None
Saves the settings of the user-modified fixture.	SYST:FIXT:SAVE	None (However, can save in a state file.)
Sends the key code for a key or a softkey on the front panel.	SYST:KEY	None
Locks the front panel keys and the rotary knob.	SYST:KLOC	**SYST:KLOC** on page 522 **SYST:KLOC:KBD** on page 522
Presets the analyzer to the preset default value.	SYST:PRES	**SYST:PRES** on page 523
Blanks the displayed frequency notation for security purposes.	SYST:SEC	None
Sets the time of the internal clock.	SYST:TIME	**SYST:TIME** on page 524
Queries the SCPI version to which the analyzer conforms.	SYST:VERS?	**SYST:VERS?** on page 524

TRACe subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Copies the data trace into the memory trace of the active channel.	TRAC:COPY TR{2-17},TR1	None
Copies the data or the memory trace of the active channel into the user trace.	TRAC:COPY TR{18-21},TR{1-17}	None (No concept of user trace.)

4291B feature	4291B GPIB command	E4991A GPIB command
Inputs data to data/memory trace arrays.	TRAC	Uses the following command to copy data to the memory trace. **CALC{1-5}:MATH:MEM** on page 341
Inputs data to user traces.	TRAC {TRX{18-21}|TRY{18-21}}	None (No concept of user trace.)
Outputs each trace's value at a specified point.	TRAC:VAL?	None (Cannot specify a measurement point to read a trace value.)
Defines the number of points of the user trace.	TRAC:POIN TR{18-21}	None (No concept of user trace.)

TRIGger subsystem:

4291B feature	4291B GPIB command	E4991A GPIB command
Selects the trigger event mode.	TRIG:EVEN:TYPE	**TRIG:EVEN** on page 525
Sets the trigger signal polarity of an external signal connected to the rear panel EXT TRIGGER input.	TRIG:SLOP	**TRIG:SLOP** on page 526
Selects the trigger source, which is common to both channels.	TRIG:SOUR	**TRIG:SOUR** on page 526

Common commands:

4291B feature	4291B GPIB command	E4991A GPIB command
Clears the Status Byte Register, the Operation Event Status Register, the Standard Event Status Register, and the Instrument Event Status Register.	*CLS	***CLS** on page 279
Sets the enable bits of the Standard Event Register.	*ESE	***ESE** on page 280
Returns the contents of the Standard Event Status Register.	*ESR?	***ESR?** on page 280
Returns a string that represents the analyzer's ID.	*IDN?	***IDN?** on page 281
Sets the Operation Completes bit to 1 when it completes all pending operations.	*OPC	***OPC** on page 281
Returns an ASCII character 1 when all pending operations have been completed.	*OPC?	***OPC?** on page 281
Queries the options installed.	*OPT?	***OPT?** on page 282
Specifies the address of a controller that is temporarily passing GPIB control to the analyzer.	*PCB	None (Path control not possible.)
Resets the analyzer to its default values.	*RST	***RST** on page 282
Sets the contents of the Status Byte Enable Resister.	*SRE	***SRE** on page 283
Returns the contents of the Status Byte Resister.	*STB?	***STB?** on page 283
Triggers the analyzer when the trigger mode is set to BUS trigger.	*TRG	***TRG** on page 284
Executes an internal self-test and returns the test result.	*TST?	***TST?** on page 284
Makes the analyzer wait until all previously sent commands are completed.	*WAI	***WAI** on page 284

E Complex Operation Programs

This appendix shows sample programs for implementing complex operations in Visual Basic and HTBasic.

Complex Operation Programs

The following section shows sample code fragments that performs addition, subtraction, multiplication, and division operations. By adding this coding to your program, it can handle addition, subtraction, multiplication, and division operations on complexes.

Sample Implementation in Visual Basic

The following is a sample program in Visual Basic that performs addition, subtraction, multiplication, and division operations on complexes. At first, a Type statement is used to define the complex type name Complex. Then, the Function procedure is used to code addition, subtraction, multiplication, and division operations as four separate user-defined functions. The variables used in this program are as follows:

a, b	Complexes to be operated
c	Variable to which an operation result is assigned
Re, Im	Real (Re) and imaginary (Im) components of a complex

These functions can be called from a main program.

Example E-1 **Example of Complex Operation Program in Visual Basic**

```
Option Explicit
Public Type Complex
  Re As Double
  Im As Double
End Type
`
` Adding Complex
`
Public Function complex_add(a As Complex, b As Complex) As Complex
  Dim c As Complex
  c.Re = a.Re + b.Re
  c.Im = a.Im + b.Im
  complex_add = c
End Function
`
` Substracting Complex
`
Public Function complex_sub(a As Complex, b As Complex) As Complex
  Dim c As Complex
  c.Re = a.Re - b.Re
  c.Im = a.Im - b.Im
  complex_sub = c
End Function
`
` Multiplying Complex
`
Public Function complex_mul(a As Complex, b As Complex) As Complex
  Dim c As Complex
  c.Re = a.Re * b.Re - a.Im * b.Im
  c.Im = a.Re * b.Im + a.Im * b.Re
  complex_mul = c
End Function
```

```
`
` Dividing Complex
`
Public Function complex_div(a As Complex, b As Complex) As Complex
  Dim c As Complex
  Dim de As Double
  de = b.Re ^ 2 - b.Im ^ 2
  c.Re = (a.Re * b.Re + a.Im * b.Im) / de
  c.Im = (a.Im * b.Re - a.Re * b.Im) / de
  complex_div = c
End Function
```

Sample Implementation in HTBasic

The following is a sample program in HTBasic that performs addition, subtraction, multiplication, and division operations on complexes. The variables used in the program are as follows.

A(*), B(*)	Array to be operated. The index of this array starts with 1.
C(*)	Array in which operation results are stored. The index of this array starts with 1.
Nop	The upper limit of the index value into the array.

Example E-2 **Example of Complex Operation Program in HTBasic**

```
10      !
20      ! Adding Complex Arrays
30      !
40      SUB Complex_add(A(*),B(*),C(*),Nop)
50        INTEGER I,J
60        FOR I=1 TO Nop
70          FOR J=1 TO 2
80            C(I,J)=A(I,J)+B(I,J)
90          NEXT J
100       NEXT I
110     SUBEND
120     !
130     ! Substracting Complex Arrays
140     !
150     SUB Complex_sub(A(*),B(*),C(*),Nop)
160       INTEGER I,J
170       FOR I=1 TO Nop
180         FOR J=1 TO 2
190           C(I,J)=A(I,J)-B(I,J)
200         NEXT J
210       NEXT I
220     SUBEND
230     !
240     ! Multiplying Complex Arrays
250     !
260     SUB Complex_mul(A(*),B(*),C(*),Nop)
270       INTEGER I
280       FOR I=1 TO Nop
290         C(I,1)=A(I,1)*B(I,1)-A(I,2)*B(I,2)
300         C(I,2)=A(I,1)*B(I,2)+A(I,2)*B(I,1)
310       NEXT I
```

```
320     SUBEND
330     !
340     ! Dividing Complex Arrays
350     !
360     SUB Complex_div(A(*),B(*),C(*),Nop)
370       INTEGER I
380       REAL De
390       FOR I=1 TO Nop
400         De=(B(I,1)^2-B(I,2)^2)
410         IF De=0 THEN Err
420         C(I,1)=(A(I,1)*B(I,1)+A(I,2)*B(I,2))/De
430         C(I,2)=(A(I,2)*B(I,1)-A(I,1)*B(I,2))/De
440       NEXT I
450       GOTO Ext
460 Err: DISP "DIVISION BY 0"
470 Ext: !
480     SUBEND
```

F List of Responses to Measurement Failure

This appendix lists the Agilent E4991A’s responses to various types of measurement failure.

Behavior under Abnormal Measurement Conditions

This section describes abnormal conditions that may occur during measurement and explains the resulting LCD display and GPIB output and how to cope with them.

- Overload
  This situation is detected when an internal circuit is temporally overloaded due to connection or disconnection of a DUT during measurement. If this failure occurs frequently during normal measurement, the instrument may be out of order.
- DC Bias Overload
  This situation is detected when overcurrent suddenly runs in a bias circuit. If this failure occurs frequently during normal measurement, the instrument may be out of order.
- PLL Unlock
  This situation is detected when E4991A has failed to synchronize an external reference signal. If this failure occurs frequently during normal measurement, the instrument may be out of order.
- DC Bias Current/Voltage Limitation
  This situation is detected when set voltage or current cannot be applied because of limited dc bias current or voltage. This does not always indicate an instrument failure.

Table F-1 Behavior under Abnormal Measurement Conditions

Event	Screen display	Questionable Status Hardware Event Register	Measurement value	Suggested action
Overload	"RF Overload" appears in status line.	Bit 3 is set to 1.	Indefinite	Do not connect or disconnect the DUT during measurement.
DC bias Overload	"DC Bias Overload" appears in status line.	Bit 2 is set to 1.	Measurement is performed at a voltage other than the set DC bias voltage.	Do not connect or disconnect the DUT during measurement.
PLL Unlock	"PLL Unlock" appears in status line.	Bit 1 is set to 1.	Indefinite	If an external reference signal out of specification is input, input a signal in accordance with the specification.
DC bias current/voltage limitation is imposed	"Bias Lmt" appears in DC bias status.	N/A	Measurement is performed at limited DC bias voltage/current.	Change the maximum current limit or maximum voltage limit.

G Messages

The Agilent E4991A provides error messages as well as messages that indicate the internal operating status of the equipment. This appendix describes such messages in order of error number. To search for E4991A error messages in alphabetical order, please refer to the *Operation Manual*.

Messages showing the status of the E4991A are displayed in the lower left of the E4991A LCD screen. The messages include error messages that occur during the execution of GPIB commands and others that indicate the internal status of the equipment.

Error messages are indicated following the character string “[Err]”, and can be read out by a GPIB command. On the other hand, messages other than these are indicated without the “[Err]” character string, and cannot be read out using a GPIB command. In this section the content and method of resolving each message will be explained.

Order of Error Number

Errors with a negative error numbers are basically general errors for GPIB instruments defined by IEEE488.2. On the other hand, errors with a positive error numbers are ones defined specifically for the E4991A.

0 **(no error)**

No error has occurred.

This message will not be shown on the LCD display but rather, when **SYST:ERR?** command on page 517 has been sent on GPIB, in case when the equipment find no occurrence of an error, the message will be returned as an error number 0.

6 **Additional standards needed**

Before ending all data measurement requiring the calculation of calibration factors, a GPIB command has been sent to turn the calibration function On. For example, when the measurement of Open Standard and Short Standard of the calibration kit is in full completion, **SENS:CORR1:COLL:SAVE** command on page 439 was attempted to be used to set the calibration function On.

Measure all the necessary calibration data.

7 **Calibration required**

During when the calibration function has not been set to On, a GPIB command, which is only possible to be executed while the calibration function is On, has been sent. For example, during when the calibration function is Off, **SENS:CORR2:COLL** command on page 449 has been used to attempt measuring fixture compensation data.

After measuring all necessary data, turn the calibration function On.

10 **Cal measure aborted**

One of the following problems has occurred.

- During the measurement of necessary calibration/fixture compensation data, or during and after the calculation of calibration/fixture compensation factors (with calibration function turned On), setting for calibration/fixture compensation data acquired points (**Fixed, Full Range**, **Fixed, User Pwr** or **User Freq & Pwr**) has been altered. All measured calibration/fixture compensation data acquired thus far, or calibration/fixture compensation function have been invalidated.
- While the calibration/fixture compensation data acquired point setting is in the user defined point condition (**User Freq & Pwr**), during the measurement of necessary calibration/fixture compensation data, and during and after the calculation of calibration/fixture compensation factors (with the calibration function turned On), sweep condition (Sweep Range, Sweep Parameter, Measurement Points and Sweep Type) have been altered. All measured calibration/fixture compensation data acquired thus far, or calibration/fixture compensation function have been invalidated.
- During the measurement of necessary calibration data, the measurement had been interrupted by **Abort Cal Meas** button. The calibration data had been invalidated.

In order to recover the calibration/fixture compensation function or the equipment setting, which were valid just prior to the event, click **Recover Cal/Compen** State button. Also, if necessary, retry the measurement of calibration/fixture compensation data.

11 **Compensation required**

Before finishing the measurement of fixture compensation data, a command has been sent to turn the fixture compensation function On. For example, when during the measurement of Open Compensation Data has not yet finished, **SENS:CORR2:COLL:OPEN** command on page 451 have been used to attempt setting the Open Compensation Function in the fixture compensation functions to On.

Measure necessary fixture compensation data.

13 **Comp measure aborted**

During the measurement of necessary fixture compensation data, the measurement has been interrupted by **Abort Compen Meas** button. The fixture compensation data has been invalidated.

Retry measuring the fixture compensation data if necessary.

14 **Not allowed in power sweep**

Invalid command has been sent to the oscillator level sweep while in process. For example, during the oscillator level sweep, **SWE:TYPE** command on page 515 has been used to attempt setting the sweep type to log sweep. This operation is invalidated during the oscillator level sweep.

Check to see if the command is valid toward the oscillator level sweep.

15 **User cal mode only**

Before selecting a user defined calibration kit as the calibration kit, setting has been attempted by using command defining each standard of the calibration kit.

First, set the calibration kit that will be used as the user defined calibration kit and afterwards, define each standard rate for the calibration kit that is prepared by the user.

22 **printer error**

Printer did not respond to the control given from the E4991A.

Please check whether the printer's power is On or Off, connection status of cable, or paper supplies.

30 **No valid memory trace**

There was no data stored in the Memory Trace and **CALC{1-5}:MATH:FUNC** command on page 340 was used to attempt displaying the Memory Trace.

Before displaying the Memory Trace, use **CALC{1-5}:MATH:MEM** command on page 341 to store the data into the Memory Trace.

31 **Can't calculate equivalent parameters**

The measured data was not possible to make approximate calculation into the equivalent circuit parameters that was selected in the equivalent circuit model.

Retry to carry out measurement one more time select an appropriate equivalent circuit model.

32 **Must be more than 2 points for analysis**

Measurement points within the sweep range (if the partial search function is On, within the designated Searching range) are set to 2 and therefore, calculation of equivalent circuit parameter (**Calculate Parameter** button or **CALC{1-5}:EPAR** command on page 295) was not possible to be executed.

Measurement points within the sweep range (if the partial search function is On, within the designated Searching range) must be set to 3 or above.

47 **Not enough data**

The amount of data that has been transferred to the E4991A by an eternal controller was less than the amount expected by E4991A.

Match the amount of data to be transferred and the E4991A measurement points.

48 **Option not installed**

Due to the fact that option was not installed, the command that has been sent was ignored. For example, during when the option 001 (DC advice function) is not installed, **SOUR:VOLT:OFFS** command on page 480 is used to set up the DC advice voltage figures.

Please contact your nearest Agilent Technologies branch office or the company where you have purchased the equipment in order to make installation of necessary options.

61 **No data available on memory**

Marker's Statistic Analysis Function (**Statistics** button) is Off and an attempt was made to read out the statistic analysis result by using **CALC{1-5}:MST:DATA?** command on page 344.

Turn the Marker's Statistic Analysis Function to On and acquire data for statistic analysis.

62 **Can’t execute data examination**

Even though the data for statistic analysis has been acquired, an attempt has been made to read out the statistic analysis results by changing the setting conditions (such as sweep start rate) and using **CALC{1-5}:MST:DATA?** command on page 344 before the measurement have been updated.

After changing the setting conditions, wait for the measurement to be updated, and then read out the statistic analysis results.

69 **Too many segments or points**

During editing the list sweep table, setting has been attempted which will exceed the maximum figure of segment (16), maximum figure of measurement points per 1 segment, or maximum figure of total measurement points in all segments.

When setting, number of segments or measurement points should not exceed the maximum figures.

70 **Not allowed in this measurement mode**

At present a command has been sent which is not possible to be executed in the set measurement mode. For example, in case of Dielectric Measurement Mode, **SENS:CORR1:CKIT** command on page 420 has been used in order to set the calibration kit to used defined calibration kit.

Select a measurement mode will validate the command.

71 **Impedance measurement mode only**

A command has been sent which is valid for Impedance Measurement Mode only. For example, during the Magnetic Substance Measurement Mode, **SENS:CORR2:CKIT:STAN1:C** command on page 441 has been used in order to define the user defined fixture compensation kit.

Select Impedance Measurement Mode.

72 **Permittivity measurement mode only**

A command has been sent which is valid for Dielectric Measurement Mode only. For example, during the Magnetic Substance Measurement Mode, **SENS:CORR1:CKIT:STAN7:THIC** command on page 436 has been used in order to set the thickness of load standard for Dielectric Measurement.

Select Dielectric Measurement Mode.

73 **Permeability measurement mode only**

A command has been sent which is valid for Magnetic Substance Measurement Mode only. For example, during the Dielectric Measurement Mode, **CALC:FORM:PAR:MAG** command on page 302 has been used in order to set the size of the magnetic substance.

Select Magnetic Substance Measurement Mode.

77 **Invalid material size**

The definition of the size of test material in the Magnetic Substance Measurement is invalid. For example, outside diameter of the test material was attempted to set in smaller figure than the inside diameter.

Set the outside diameter of the magnetic substance bigger than that of the inside diameter.

79 **Not available for this format**

Selected measurement parameter or display format could not be executed. For example, during the Dielectric Measurement Mode or in Magnetic Substance Measurement Mode, **DISP:TRAC{1-5}:GRAT:FORM** command on page 357 has been used in order to set into unchangeable display format (Smith Chart or Admittance Chart).

Select the measurement parameter or display format which are possible to be selected.

80 **Not available for this fixture**

An invalid command has been sent toward presently selected text fixture. For example, during when the 16197A is selected, **CALC{1-5}:FORM** command on page 298 has been used in order to set into unchangeable measurement parameter (Complex dielectric constant against the complex trace).

Select the measurement parameter or display format which are possible to be selected.

90 **No marker delta - parameter not set**

Reference marker's gpcdeltauppergpc mode is in Off and **CALC{1-5}:MARK:SET** command on page 336 or **CALC{1-5}:MARK:FUNC:DOM:SPAN** command on page 319 have been used in order to set the gpcdeltauppergpc figures to span rate within the sweep range or within the partial search range.

First, use **CALC{1-5}:MARK:REF** command on page 328 to display the reference marker. Second, use **CALC{1-5}:MARK:REF:TYPE** command on page 333 to set the gpcdeltauppergpc Mode or Fixed gpcdeltauppergpc Mode to On.

92 **No active marker**

Due to the fact that marker is not displayed, the command which has been sent was ignored. For example, during when the marker is not displayed, **CALC{1-5}:MARK:SET** command on page 336 was used in attempt to change the equipment setting of the E4991A.

First use **CALC{1-5}:MARK{1-8}** command on page 304 to show marker on the display.

94 **No fixed delta marker**

Due to the fact that reference marker is not set in fixed gpcdeltauppergpc mode, the command which has been sent was ignored. For example, during when the fixed gpcdeltauppergpc mode is not set, **CALC{1-5}:MARK:REF:Y** command on page 335 is used in attempt to set the reference marker to the designated measurement rates.

First, use **CALC{1-5}:MARK:REF** command on page 328 to display the reference marker. Next, use **CALC{1-5}:MARK:REF:TYPE** command on page 333 to change the setting to fixed gpcdeltauppergpc mode.

95 **Frequency sweep only**

A command only valid during the sweep parameter is in frequency has been sent. For example, during when the sweep parameter is set other than the frequency, **CALC{1-5}:MARK:UNIT** command on page 337 is used in attempt to set the marker X-axis display to relaxation time (1/2πf).

First, use **SWE:TYPE** command on page 515 to set the sweep parameter to frequency.

104 **Save error**

During the saving of file, there was an error detected on the media in which the data is to be stored. For example, when saving the file into a floppy disk, the space available in the floppy disk was not sufficient.

Check the space available in the media in which the date is to be stored.

105 **Recall error**

During reading out (recall) a file, an error has occurred. For example, a file containing invalid data (such as the extension (.sta) equipment setting files that was saved with a equipment other than E4991A) has been attempted to read out.

Check to see if there is no problem in the file contents.

106 **Invalid file name**

During the execution of saving a file/recall command, series of characters showing a file name were inappropriate. For example, when executing a recall command, file name extension was incorrect.

Specify an appropriate file name.

Also, when saving data on a floppy disk, this error message will be shown if the disk is not (properly) inserted or the disk is write-protected.

113 **No data trace displayed**

Due to the fact that data trace is not being displayed, a command that has been sent was ignored. For example, during when the data trace is not displayed, **CALC{1-5}:MARK:ON** command on page 327 is used in attempt to set the trace which display a marker as the data trace.

First, use **CALC{1-5}:MATH:FUNC** command on page 340 to display the data trace.

114 **No memory trace displayed**

Due to the fact that memory trace is not displayed, a command that has been sent was ignored. For example, during when the memory trace is not displayed, **DISP:TRAC{1-5}:Y:FOR** command on page 366 is used in attempt to set the scale setting subject as the data trace.

First, use **CALC{1-5}:MATH:FUNC** command on page 340 to display the memory trace.

118 **Segment table empty or insufficient table**

Due to the fact that the segment sweep table has not been created, a command that has been sent was ignored. For example, before the segment sweep table has been created, **SWE:TYPE** command on page 515 is used in attempt to set a sweep type as the segment sweep.

Before carrying out a segment sweep, create the segment sweep table.

140 **Not allowed for the current trigger source**

Invalid command has been sent toward presently selected trigger source. For example, during when the trigger source is set on internal trigger (**Internal**), **TRIG:EVEN** command on page 525 is used in attempt to set the trigger event mode (Detecting point for putting trigger) at each and every measurement point (**On Point**) or at each and every segment (**On Segment**). This operation is valid only when the trigger source is set other than internal trigger.

After setting the trigger source to **Manual**, **External** or **GPIB Bus**, change the Trigger Event Mode.

-100 **Command error**

Error has occurred in which the E4991A could not grammatically specify the error message. It shows that the command error which is defined by the IEEE488.2,5.1.1.4 has occurred

-101 **Invalid character**

In the series of error message characters, invalid character has been found. For example, when a message "**SENS:CORR1:COLL:FPO USER**" is sent toward the proper program message; "**SENS:CORR1:COLL:FPO&USER**", the ampersand symbol (&) will be perceived by E4991A as an invalid character. In case the parameter is inputted at the end, provide space between the command and the parameter.

-102 **Syntax error**

There was an unrecognized command or data type. For example, when a message "**SYST:POFF**" is sent toward the proper program message; "**SYST::POFF**", a column (:) has been incorrectly inserted and it will be perceived by E4991A as unrecognized command. Delete one column (:) in order to send the appropriate command.

-103 **Invalid separator**

When the parser (compiler) was expecting a separating symbol, there was a character which is not a separating symbol. For example, when a message "**SENS:CORR1:COLL:FPO USER;*OPC?**" is sent toward the proper 2 program messages with a semi-column (;) separating the two; "**SENS:CORR1:COLL:FPO USER** *OPC?", the separating semi-column (;) will be perceived by E4991A as a space. When sending 2 program messages simultaneously, please insert a separating symbol between the two, such as semi-column (;).

-104 **Data type error**

The parser has recognized data element that should not supposed to exist. For example, even though a numerical figure or series of character data have been expected, a block data have been sent. Define the type of the recognized data.

-105 **GET not allowed**

During the receiving of program message, Group Execution Trigger (GET command in HTBasic) have been inputted (refer to IEEE4888.2,7.7). For example, send a command such as "***OPC?**", or "***WAI**" which weigh the programs.

-108 **Parameter not allowed**

Parameter exceeded the number necessary for a command.
For example, when a message "**SWE:TYPE LIN,SEGM**" is sent toward the proper program message;
"SWE:TYPE LIN", even though the parameter required for this command is 1, 2 parameters are contained. Therefore, the number of the parameter will be regarded as invalid by E4991A. Refer to the command reference and check the number of parameters required.

-109 **Missing parameter**

Parameter was less than what was necessary for a command, or the parameter has not been inputted. For example, **SWE:POIN** command requires 1 parameter and thus, when a message; "**SWE:POIN**" has been sent toward the correct program message; "**SWE:POIN 201**", it will be regarded as invalid by E4991A because the parameter has not been inputted. For command which requires parameter, make sure they are inputted.

-112 **Program mnemonic too long**

The length of header is exceeding than 12 characters. The length of header would here refer to the length of the series of characters that are separated with the use of columns (:). Refer to IEEE488.2,7.6.4.1 for further details.

-113 **Undefined header**

Though the grammatical structure does not provide any problems, a command not defined by E4991A has been received. For example, when a message; "**DISP:TRAC1:X:AUTO**" has been sent toward the correct program message; "**DISP:TRAC1:Y:AUTO**", it will be received by E4991A as an undefined command. Refer to the command reference and check the correct commands.

-120 **Numeric data error**

Error that was caused by numeric data (including the numeric data other than 10 decimal numbers) has occurred. From error numbers - 121 to - 121 unspecified numeric error has occurred.

-121 **Invalid character in number**

There were invalid characters toward the received data and type. For example, within the 10 decimal numeric data, an alphabet is found, or within 8 decimal numeric data, 9 was found.

-123 **Exponent too large**

Absolute figure of the exponent has exceeded to over 32,000. (Refer to IEEE488.2, 7.2.4.1)

-124 **Too many digits**

Mantissa’s number of digits in the 10 decimal numeric data element is exceeding over 255, except the preceding 0. (Refer to IEEE488.27.7.2.4)

-128 **Numeric data not allowed**

On the position where E4991A would not receive numeric data element, the numeric data element has been received. For example, when a message; "**CALC1:FORM 3**" has been sent toward the correct program message; "CALC1:FORM RS", the numeric data element will be received by E4991A as invalid. Refer to the command reference and check the parameter that should be used for this command.

-131 **Invalid suffix**

Suffix (here meaning Unit) is not following the sentence structure defined by IEEE488.2, 7.7.3.2, or the suffix is not appropriate for E4991A. For example, when a message; "**SOUR:VOLT:STAR 10dbm**" has been sent toward the correct program message; "SOUR:VOLT:STAR 10mV", the suffix will be regarded by E4991A as invalid. Refer to the command reference and check the unit that should be used for this command.

-134 **Suffix too long**

Suffix (here meaning Unit) display is written in over 12 characters. (Refer to IEEE488.2, 7.7.2.4)

-138 **Suffix not allowed**

After the numeric data in which the suffix (here meaning Unit) can not be inputted, the suffix have been added. For example, when a message; "**DISP:TRAC1:Y:PDIV 0.01rad**" has been sent toward the correct program message; "DISP:TRAC1:Y:PDIV 0.01", the suffix will be regarded by E4991A as invalid. Refer to the command reference and check

to see if the suffix can be added to the numeric data element.

-148 **Character data not allowed**

On the position where E4991A would not receive character data element, the character data element (not violate the standard) has been found. For example, when a message; "**CALC1:MARK:FUNC:TARG MAX**" has been sent toward the correct program message; "**CALC1:MARK:FUNC:TARG le-12**", the character data element will be regarded by E4991A as invalid. Refer to the command reference and check the parameter to be used for that command.

-150 **String data error**

Error has occurred which is caused by received series of character data element (quotation mark character). From error - 151 to - 159, unspecified error has occurred in the series of characters.

-151 **Invalid string data**

Even though the series of character data were expected, the appeared series of character is invalid for some reason. (Refer to IEEE488.2, 7.7.2.4) For example, before the closing quotation mark character has appeared, END message was received.

-158 **String data not allowed**

On the position where E4991A would not receive character data element, the character data element has been found. For example, when a message; "**TRIG:SOUR "MAN"**" has been sent toward the correct program message; "**TRIG:SOUR MAN**", the double quote ("") will be regarded by E4991A as invalid. Refer to the command reference and check to see if the double quote ("") is required in the parameter for that command.

-161 **Invalid block data**

Even though the block data had been expected, the appeared block data is invalid for some reason. (Refer to IEEE488.2, 7.7.6.2) For example, before the length of block data has been filled, END message was received.

-168 **Block data not allowed**

On the position where E4991A would not receive block data element, the block data element has been found.

-170 **Expression error**

During the structure analysis of the expression data, an error that does not apply in between errors -171 and - 179 has been occurred.

-171 **Invalid expression**

Expression data element is invalid. (Refer to IEEE488.2, 7.7.7.2) For example, the brackets are not paired or the character is violating the standard.

-178 **Expression data not allowed**

On the position where E4991A would not receive expression data element, the expression data element has been found.

-200 **Execution error**

There was an execution error in which the E4991A could not specify the error message. This code shows that execution error defined in IEEE488.2, 11.5.1.1.5 has occurred.

-211 **Trigger ignored**

Trigger command ("***TRG**"), or external trigger signal has been received and detected by E4991A but because of the timing with the E4991A (For example, the E4991A trigger was not in waiting condition), it was ignored. When the trigger becomes the waiting condition, set to prepare for trigger command or external trigger signal to be sent.

-213 **Init ignored**

Due to the fact that other measurement was already underway, the Measurement Initialize Request ("**INIT**" command) was ignored. For example, change the setting of "**INIT:CONT**" to "**OFF**" and "**TRIG:SOUR**" command to "**BUS**" and trigger with "***TRG**" command. Until the sweep is completed a weight will be pressured when sending "**INIT**" command, it will be regarded as E4991A.

-221 **Settings conflict**

Even though the program data element has beel received and it conforms to the standard, with the present condition of E4991A, the present day condition, execution is not possible.

-222 **Data out of range**

Data element well out of range (not violating the standard) from the E4991A defined range has been received.

-223 **Too much data**

Even though the program data received in block, expression, or series of characters conformed to the standard, due to the fixed condition of memory or memory related devices, the capacity is over what E4991A can hold.

-224 **Illegal parameter value**

Parameter rate is not appropriate. For example, when a message; "**DISP:TRAC1:Y:SPAC OBAS**" has been sent toward the correct program message; "DISP:TRAC1:Y:SPAC LOG", the parameter rate will be regarded by E4991A as inappropriate. Refer to the command reference and check to see if the parameter rates is correctly inputted.

-230 **Data corrupt or stale**

Data may have the possibility to be invalid. Also, the newly started reading procedure has not been completed since its latest updated access.

-256 **File name not found**

Designated file could not be found and the command was not correctly executed. For example, when attempts have been made to read and write on a file that does not exist, or when a disk is not inserted (properly), this error would occur.

-261 **Math error in expression**

A syntactically legal expression program data element could not be executed due to a math error such as a divide-by zero was attempted.

-272 **Macro execution error**

The E4991A macro-related execution error occurred.

-310 **System error**

On E4991A, either of the following so called "System Error" has occurred.

-321 **Out of memory**

Memory (RAM) is in shortage.

-400 **Query error**

E4991A has found Query error which is not able to specify the error message. This code shows that Query error defined in IEEE488.2, 11.5.1.1.7 or 6.3 has occurred.

-410 **Query INTERRPUTED**

This is a condition to create "INTERRUPTED" Query error. (Refer to IEEE488.1, 6.3.2.3) This error is generated when, for example, after the Query and while its response may not be fully sent, data byte "DAB" or Get have been received.

-420 **Query UNTERMINATED**

This is a condition to create "UNTERMINATED" Query error. (Refer to IEEE488.1, 6.3.3.2). This error occurs when the E4991A is designated as a talker (if designated as a controller, data transmission is possible via interface) and receive incomplete program message to E4991A. For example, when a command without the Query such as "***CLS**" has been sent by sending "***CLS?**" command, it will be regarded as incomplete message by E4991A. Refer to the command reference for checking.

-430 **Query DEADLOCKED**

This is a condition to create "DEADLOCK" Query error. (Refer to IEEE488.2, 6.3.1.7) This error occurs for example, when both buffers on input and output becomes full and when the E4991A is no longer able to carry out the process.

-440 **Query UNTERMINATED after indefinite response**

Within the same program message, after the Query execution requiring indefinite response and also the Query has been received. (Refer to IEEE488.2, 6.5.7.5.7)

Messages indicating the internal status of the equipment

Messages that indicate the internal status of the equipment include messages indicating irregularities of the equipment as well as those indicating the results of processing (elapsing). These messages do not have numbers.

Messages indicating the measurement failure

DC bias overload

During DC bias voltage application, there was a sudden change on the connecting condition of DUT, the direct-current impedance has lowered, resulting in momentary over-current on the DC bias source.

Do not remove DUT during the DC bias application. When this error occurs frequently during normal measurement, there may be a possible failure on the instrument. When that is the case, please contact your nearest Agilent Technologies branch office or company where you have purchased the instrument.

PLL Unlock

Error has been detected in the internal PLL (Phase Lock Loop) circuit of the E4991A. PLL is used to generate a stable frequency source. It could occur with error on the external reference signal, or when turning the power ON in the lower temperature.

If the external reference signal is not inputted or have no error, instrument tuning or repair is necessary. If the message does not disappear in a few minutes after turning the power ON, instrument tuning or repair is necessary. Please contact your nearest Agilent Technologies branch office or company where you have purchased the instrument.

Power on test failed

Error was detected during self-test after loading the power.

Please contact your nearest Agilent Technologies branch office or company where you have purchased the instrument.

RF overload

Due to the sudden change of impedance caused by removal of DUT or other reasons during the measurement, there was a failure of ranging in the internal circuit.

Do not remove DUT during the measurement. When this error occurs frequently during normal measurement, there may be a possible failure on the instrument. When that is the case, please contact your nearest Agilent Technologies branch office or company where you have purchased the instrument.

Messages indicating the results of processing (elapsing)

Cal done

Calculation and storing of a calibration coefficient completed.

Cal measure aborted

Measurement of calibration data aborted.

Comp done

Calculation and storing of a fixture compensation coefficient completed.

Comp measure aborted

Measurement of a fixture compensation coefficient aborted.

Peak not found

Peak search function executed, but defined peak not found.

Target value not found

Target search function executed, but target measurement value not found.

Trigger hold

Measurement is in hold mode (mode that does not accept trigger).

Wait -- measuring cal standard

-- Calibration data being measured.

Wait -- measuring comp standard

-- Fixture compensation data being measured.

Symbols

*.bas, 221
*.bmp, 177
*.dat, 177, 178
*.frm, 221
*.jpg, 177
*.lcr, 177, 178, 221
*.sta, 177, 178
*.txt, 177

A

ASCII format, 120
auto scale, 51
Autorec.sta, 178
Autost.lcr, 230
averaging
  point averaging factor
    under linear/log sweep, 50
    under segment sweep, 65
  sweep averaging
    averaging factor, 50
    on/off, 50
    reset, 50
  turns on/off point averaging
    under linear/log sweep, 50

B

backlight, 198
basic measurement programs, 254
beep sounds, 516
binary format
  byte order, 122
block
  Font rules in this manual, 3
bold
  Font rules in this manual, 2
box
  Font rules in this manual, 3
button
  Font rules in this manual, 3

C

calibration
  calibration coefficient array, 126
  calibration data array, 125
  clears calibration data/coefficient array, 77
  detects measurement end
    using COM interface, 537
    using GPIB command, 76
  detects measurement start
    using COM interface, 538
    using GPIB command, 76
  disables calibration, 76
  measurement done (enables calibration), 76
  measurement points, 75
  measures calibration data
    using COM interface, 533
    using GPIB command, 76
  reads calibration data array, 77
  sets/reads calibration coefficient array, 77
calibration kit
  defines standard values using list setting function, 74
  defines standard values without using list setting function, 74
  selection, 74
  turns on/off list setting function, 74
CITIfile
  save, 177
COM
  #, 544
  *, 544
  copies screen image to clipboard, 535
  copies text data to clipboard, 535
  event for DC bias overload error, 539
  event for PLL Unlock error, 539
  event for RF overload error, 540
  event for specified sweep end, 537
  event for specified sweep start, 538
  event for sweep averaging completion, 538
  executes sweep, 532
  GPIB command vs. COM, 239
  how to read the comma separated data (array data), 547
  measures calibration data, 533
  measures fixture compensation data, 534
  reads the returned value of the GPIB command, 542
  receives GPIB query response, 543
  sends GPIB command using COM, 239, 543
  sets wait time for event, 536
COM Interface
  CalMeasure method, 533
  CompenMeasure method, 534
  CompleteSweepAveraging event, 538
  Connection property, 531
  DcBiasOverload event, 539
  Enter method, 542
  GetScreenImage method, 535
  GetTextData method, 535
  Name property, 530, 541
  Output method, 543
  Query method, 543
  RfOverload event, 540
  SingleMeasure method, 532
  SweepEnd event, 537
  SweepStart event, 538
  Unlocked event, 539
  VBAVersion property, 530
  WaitForEvent method, 536
complex operation program, 600
complex trace, 40
CW frequency, 48

D

data array, 124
data file

recall, 178
save, 177
data trace array, 124
date
setting, 517
DC bias
application program for DC power supply, 248
application program for DC power supply(external instrument), 251
dc bias
current limit maximum value, 49
DC bias current/voltage limitation error, 604
DC bias overload error, 604
in case of segment sweep
current limit maximum value, 65
output current level, 65
output voltage level, 65
voltage limit maximum value, 65
monitor function
dc bias level monitor array, 124
on/off, 49
output current level, 49
output voltage level, 49
turns current output on/off, 49, 65
turns voltage output on/off, 49, 65
voltage limit maximum value, 49
dc bias current sweep
selects dc bias current sweep, 44
sweep range, 46
turns output on/off, 46
voltage limit maximum value, 46
dc bias voltage sweep
current limit maximum value, 46
selects dc bias voltage sweep, 44
sweep range, 46
turns output on/off, 46
delay time, 47
dielectric material measurement
calibration
definition of load standard, 75
selects load standard, 75
selection of measurement mode, 40
thickness of DUT, 40
display
backlight, 198
enable/disable display update, 198
measurement screen, 198
split/overlay, 198
timing of refresh, 200
display format
in case of complex trace, 43
in case of scalar trace, 42

E

E4991A library
object browser, 228
where to install, 244
equivalent circuit analysis
equivalent circuit model, 167
performs equivalent circuit analysis, 168
simulates frequency characteristics, 168
error message
error queue, 202
list, 605
event, 238
external controller, 27
external instruments
controlling external instruments from E4991A, 245
external reference signal
input, 518

F

file
catalog, 176
copying, 179
deleting, 179
renaming, 179
fixed frequency / fixed power points calibration, 75
fixed frequency / fixed power points compensation, 94
fixed frequency / user defined power points compensation, 94
fixed frequency / user-defined power points calibration, 75
fixture compensation
detects measurement end
using COM interface, 537
using GPIB command, 95
detects measurement start
using COM interface, 538
fixture compensation coefficient array, 128
fixture compensation data array, 127
measurement done (enable function), 95
measures fixture compensation data
using COM interface, 534
using GPIB command, 95
reads fixture compensation data array, 96
selects measurement points, 94
sets/reads fixture compensation coefficient array, 96
fixture compensation kit
defines standard values using list setting function, 93
defines standard values without using list setting function, 93
turns on/off list setting function, 93
folder
creating, 179
current folder, 176
deleting, 179
Font
Font rules in this manual, 2
frequency sweep
selects frequency sweep, 44
sweep range
under linear/log sweep, 45
front panel
lock, 31

G

GPIB
  controller mode, 33, 551
  system controller
    pass control, 28
  what is GPIB, 26
GPIB command
  *CLS, 279
  *ESE, 280
  *ESR?, 280
  *IDN?, 281
  *OPC, 281
  *OPC?, 281
  *OPT?, 282
  *RST, 282
  *SRE, 283
  *STB?, 283
  *TRG, 284
  *TST?, 284
  *WAI, 284
  [SENSe:]AVERage:COUNt, 288
  [SENSe:]AVERage[:STATe], 287
  [SENSe:]FREQuency:CENTer, 376
  [SENSe:]FREQuency:SPAN, 377
  [SENSe:]FREQuency:SPAN:FULL, 377
  [SENSe:]FREQuency:STARt, 378
  [SENSe:]FREQuency:STOP, 379
  [SENSe:]FREQuency[:CW|:FIXed], 375
  [SENSe:]SEGMent:CURRent:OFFSet:STATe, 399
  [SENSe:]SEGMent:CURRent:STATe, 402
  [SENSe:]SEGMent:DATA:ALL, 405
  [SENSe:]SEGMent:DELete:ALL, 406
  [SENSe:]SEGMent:POWer:STATe, 412
  [SENSe:]SEGMent:VOLTage:OFFSet:STATe, 417
  [SENSe:]SEGMent:VOLTage:STATe, 418
  [SENSe:]SEGMent{1-16}:AVERage:COUNt, 396
  [SENSe:]SEGMent{1-16}:CURRent:LIMit, 400
  [SENSe:]SEGMent{1-16}:CURRent:OFFSet, 401
  [SENSe:]SEGMent{1-16}:CURRent[:LEVel], 398
  [SENSe:]SEGMent{1-16}:DATA, 403
  [SENSe:]SEGMent{1-16}:FREQuency:CENTer, 407
  [SENSe:]SEGMent{1-16}:FREQuency:SPAN, 408
  [SENSe:]SEGMent{1-16}:FREQuency:STARt, 409
  [SENSe:]SEGMent{1-16}:FREQuency:STOP, 410
  [SENSe:]SEGMent{1-16}:POWer[:LEVel], 411
  [SENSe:]SEGMent{1-16}:SWEep:POINts, 413
  [SENSe:]SEGMent{1-16}:VOLTage:LIMit, 415
  [SENSe:]SEGMent{1-16}:VOLTage:OFFSet, 416
  [SENSe:]SEGMent{1-16}:VOLTage[:LEVel], 414
  [SENSe:]SWEep:DIRection, 508
  [SENSe:]SWEep:DWELl1, 508
  [SENSe:]SWEep:DWELl2, 509
  [SENSe:]SWEep:DWELl3, 510
  [SENSe:]SWEep:POINts, 511
  [SENSe:]SWEep:STIMulus{1-4}?, 512
  [SENSe:]SWEep:TIME, 513
  [SENSe:]SWEep:TIME:AUTO, 514
  [SENSe:]SWEep:TYPE, 515
  [SENSe:}SEGMent:COUNt, 397
  [SENSe]:MODE, 393
  4291B commands vs. E4991A commands, 580
  ABORt, 286
  CALC{1-5}:MARKer:FUNCtion:DOMain:LIMit ALL[:STATe], 314
  CALC{1-5}:MARKer:FUNCtion:DOMain:SPAN, 319
  CALC{1-5}:MARKer:FUNCtion:DOMain:STARt, 320
  CALC{1-5}:MARKer:FUNCtion:DOMain:STOP, 320
  CALC{1-5}:MARKer:FUNCtion:EXECute:LEFT, 322
  CALC{1-5}:MARKer:FUNCtion:EXECute:NEXT, 322
  CALC{1-5}:MARKer:FUNCtion:EXECute:RIGHt, 323
  CALC{1-5}:MARKer:SET, 336
  CALC{1-5}:MARKer{1-8}:FUNCtion:DOMain:LIMit:LOWer, 316
  CALC{1-5}:MARKer{1-8}:FUNCtion:DOMain:LIMit:UPPer, 318
  CALC{1-5}:MARKer{1-8}:FUNCtion:DOMain:LIMit[:STATe], 313
  CALCulate:AVERage:CLEar, 289
  CALCulate:AVERage:COUNt, 290
  CALCulate:AVERage[:STATe], 289
  CALCulate:DATA:MONitor?, 292
  CALCulate:FORMat:PARameter:DIElectric, 300
  CALCulate:FORMat:PARameter:MAGnetic, 302
  CALCulate[:EVALuate]:BMONitor[:STATe], 291
  CALCulate{1-3}:MATH:OFFSet, 342
  CALCulate{1-5}:DATA:EPARameter, 294
  CALCulate{1-5}:DATA?, 293
  CALCulate{1-5}:EPARameters, 295
  CALCulate{1-5}:EPARameters:CIRCuit[:TYPE], 296
  CALCulate{1-5}:EPARameters:SIMulation, 297
  CALCulate{1-5}:FORMat, 298
  CALCulate{1-5}:FORMat:PARameter:EPHase, 301
  CALCulate{1-5}:FORMat:UNIT:ANGLe, 303
  CALCulate{1-5}:MARKer:AOFF, 305
  CALCulate{1-5}:MARKer:APEak:SET, 306
  CALCulate{1-5}:MARKer:COUPle, 309
  CALCulate{1-5}:MARKer:FUNCtion:DOMain:LIMit:ALL:RESult?, 315
  CALCulate{1-5}:MARKer:LIST, 326
  CALCulate{1-5}:MARKer:ON, 327
  CALCulate{1-5}:MARKer:REFerence:ACTivate, 329
  CALCulate{1-5}:MARKer:REFerence:FUNCtion:DOMain:LIMit:RESult?, 331
  CALCulate{1-5}:MARKer:REFerence:FUNCtion:DOMain:LIMit:UPPer, 330, 332
  CALCulate{1-5}:MARKer:REFerence:FUNCtion:DOMain:LIMit[:STATe], 329
  CALCulate{1-5}:MARKer:REFerence:X, 334
  CALCulate{1-5}:MARKer:REFerence:Y, 335
  CALCulate{1-5}:MARKer:UNIT, 337
  CALCulate{1-5}:MARKer{1-8}:ACTivate, 305
  CALCulate{1-5}:MARKer{1-8}:APEak:EXCursion:X, 307

Index

CALCulate{1-5}:MARKer{1-8}:APEak:EXCursion:Y, 308
CALCulate{1-5}:MARKer{1-8}:DISCrete, 309
CALCulate{1-5}:MARKer{1-8}:FORMat, 310
CALCulate{1-5}:MARKer{1-8}:FUNCtion:DOMain:LIMit:RESult?, 317
CALCulate{1-5}:MARKer{1-8}:FUNCtion:DOMain[:STATe], 312
CALCulate{1-5}:MARKer{1-8}:FUNCtion:EXECute, 321
CALCulate{1-5}:MARKer{1-8}:FUNCtion:TARGet, 324
CALCulate{1-5}:MARKer{1-8}:FUNCtion:TRACking, 325
CALCulate{1-5}:MARKer{1-8}:FUNCtion[:SELect], 311
CALCulate{1-5}:MARKer{1-8}:X, 338
CALCulate{1-5}:MARKer{1-8}:Y?, 339
CALCulate{1-5}:MARKer{1-8}[:STATe], 304
CALCulate{1-5}:MARKerREFerence:TYPE, 333
CALCulate{1-5}:MARKerREFerence[:STATe], 328
CALCulate{1-5}:MATH:FUNCtion, 340
CALCulate{1-5}:MATH:MEMorize, 341
CALCulate{1-5}[:EVALuate]:MSTatistics:DATA?, 344
CALCulate{1-5}[:EVALuate]:MSTatistics[:STATe], 343
command reference
  indicate rule, 238
DATA[:DATA]:CAD{1-8}?, 345
DATA[:DATA]:CCO{1-6}, 346
DATA[:DATA]:CMD{1-2}?, 347
DATA[:DATA]:CMP{1-3}, 348
DATA[:DATA]:RAW?, 349
DATA[:DATA]:SEGMent{1-16}:CAD{1-8}?, 350
DATA[:DATA]:SEGMent{1-16}:CCO{1-6}, 351
DATA[:DATA]:SEGMent{1-16}:CMD{1-2}?, 352
DATA[:DATA]:SEGMent{1-16}:CMP{1-3}?, 353
DISPlay:BACKlight, 354
DISPlay:ENABle, 354
DISPlay[:WINDow]:FORMat, 355
DISPlay[:WINDow]:TEXT[:STATe], 355
DISPlay[:WINDow]:TEXT{1-3}:SET, 356
DISPlay[:WINDow]:TRACe:Y[:SCALe]:AUTO:ALL, 364
DISPlay[:WINDow]:TRACe{1-3}:REFerence[:STATe], 358
DISPlay[:WINDow]:TRACe{1-3}:Y:SPACing, 371
DISPlay[:WINDow]:TRACe{1-3}:Y[:SCALe]:BOTTom, 365
DISPlay[:WINDow]:TRACe{1-3}:Y[:SCALe]:RPOSitionl, 370
DISPlay[:WINDow]:TRACe{1-3}:Y[:SCALe]:TOP, 372
DISPlay[:WINDow]:TRACe{1-5}:GRATicule:FORMat, 357
DISPlay[:WINDow]:TRACe{1-5}:SELect, 358
DISPlay[:WINDow]:TRACe{1-5}:TEXT:PAGE, 359
DISPlay[:WINDow]:TRACe{1-5}:TEXT[:STATe], 359
DISPlay[:WINDow]:TRACe{1-5}:TITLe:DATA, 361
DISPlay[:WINDow]:TRACe{1-5}:TITLe[:STATe], 360
DISPlay[:WINDow]:TRACe{1-5}:X:SPACing, 363
DISPlay[:WINDow]:TRACe{1-5}:Y:AUTO, 364
DISPlay[:WINDow]:TRACe{1-5}:Y[:SCALe]:FOR, 366
DISPlay[:WINDow]:TRACe{1-5}:Y[:SCALe]:FULL, 367
DISPlay[:WINDow]:TRACe{1-5}:Y[:SCALe]:PDIVision, 368
DISPlay[:WINDow]:TRACe{1-5}:Y[:SCALe]:RLEVel, 369
DISPlay[:WINDow]:TRACe{1-5}[:STATe], 356
DISPlay[:WINDow]:TRACe{4-5}:X[:SCALe]:RLEVel, 362
E4991A commands, 29
FORMat:BORDer, 373
FORMat:DATA, 374
HCOPy:ABORt, 380
HCOPy:CONTent, 380
HCOPy:IMAGe, 381
HCOPy[:IMMediate], 380
IEEE common commands, 29
INITiate:CONTinuous, 382
INITiate[:IMMediate], 382
list by function, 568
MMEMory:CATalog?, 383
MMEMory:CDIRectory, 383
MMEMory:COPY, 384
MMEMory:DELete, 384
MMEMory:LOAD:MACRo, 385
MMEMory:LOAD:TRACe, 386
MMEMory:LOAD[:STATe], 385
MMEMory:MDIRectory, 386
MMEMory:MOVE, 387
MMEMory:RDIRectory, 388
MMEMory:STORe:CITI{1-3}, 389
MMEMory:STORe:GRAPh:BMP, 390
MMEMory:STORe:GRAPh[:JPG], 389
MMEMory:STORe:MACRo, 390
MMEMory:STORe:TRAC[:BINary], 391
MMEMory:STORe:TRACe:ASCii, 391
MMEMory:STORe:TRACe:SELect{1-4}, 392
MMEMory:STORe[:STATe], 388
PROGram:CATalog?, 394
PROGram[:SELected]:NAME, 394
PROGram[:SELected]:STATe, 395
PROGram[:SELected]:WAIT, 395
SENSe:CORRection1:CKIT, 420
  LIST[:STATe], 421
SENSe:CORRection1:CKIT:STANdard1:C, 422
SENSe:CORRection1:CKIT:STANdard1:G, 423
SENSe:CORRection1:CKIT:STANdard1:LIST:B, 424
SENSe:CORRection1:CKIT:STANdard1:LIST:G, 425
SENSe:CORRection1:CKIT:STANdard2:L, 426
SENSe:CORRection1:CKIT:STANdard2:LIST:R, 427
SENSe:CORRection1:CKIT:STANdard2:LIST:X, 428
SENSe:CORRection1:CKIT:STANdard2:R, 429
SENSe:CORRection1:CKIT:STANdard3:L, 430
SENSe:CORRection1:CKIT:STANdard3:LIST:R, 431, 443
SENSe:CORRection1:CKIT:STANdard3:LIST:X, 432
SENSe:CORRection1:CKIT:STANdard3:R, 433

SENSe:CORRection1:CKIT:STANdard7:PLFactor, 434
SENSe:CORRection1:CKIT:STANdard7:PREal, 435
SENSe:CORRection1:CKIT:STANdard7:THICkness, 436
SENSe:CORRection1:COLLect:FPOints, 438
SENSe:CORRection1:COLLect:SAVE, 439
SENSe:CORRection1:COLLect[:ACQuire], 437
SENSe:CORRection1[:STATe], 419
SENSe:CORRection2:CKIT:LIST[:STATe], 440
SENSe:CORRection2:CKIT:STANdard1:C, 441
SENSe:CORRection2:CKIT:STANdard1:G, 442
SENSe:CORRection2:CKIT:STANdard1:LIST:G, 444
SENSe:CORRection2:CKIT:STANdard2:L, 445
SENSe:CORRection2:CKIT:STANdard2:LIST:R, 446
SENSe:CORRection2:CKIT:STANdard2:LIST:X, 447
SENSe:CORRection2:CKIT:STANdard2:R, 448
SENSe:CORRection2:COLLect:FPOints, 450
SENSe:CORRection2:COLLect:OPEN[:STATe], 451
SENSe:CORRection2:COLLect:SAVE, 451
SENSe:CORRection2:COLLect:SHORt[:STATe], 452
SENSe:CORRection2:COLLect[:ACQuire], 449
SENSe:CORRection2:EDELay:TIME, 453
SENSe:CORRection2:FIXTure, 454
SENSe:CORRection2:FIXTure:EDELay:MODEl:DISTance?, 455
SENSe:CORRection2:FIXTure:EDELay:USER:DISTance, 456
SOURce:CURRent:CENTer, 458
SOURce:CURRent:LIMit:OFFSet, 459
SOURce:CURRent:MODE, 460
SOURce:CURRent:SPAN, 467
SOURce:CURRent:STARt, 468
SOURce:CURRent:STOP, 469
SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude], 457
SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet, 461
SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet:CENTer, 462
SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet:SPAN, 463
SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STARt, 464
SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STATe, 465
SOURce:CURRent[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STOP, 466
SOURce:POWer:CENTer, 471
SOURce:POWer:MODE, 472
SOURce:POWer:SPAN, 473
SOURce:POWer:STARt, 474
SOURce:POWer:STOP, 475
SOURce:POWer[:LEVel][:IMMediate][:AMPLitude], 470
SOURce:VOLTage:CENTer, 477
SOURce:VOLTage:LIMit:OFFSet, 478
SOURce:VOLTage:MODE, 479
SOURce:VOLTage:SPAN, 486
SOURce:VOLTage:STARt, 487
SOURce:VOLTage:STOP, 488
SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude], 476
SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet, 480
SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet:CENTer, 481
SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet:SPAN, 482
SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STARt, 483
SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STATe, 484
SOURce:VOLTage[:LEVel][:IMMediate][:AMPLitude]:OFFSet:STOP, 485
STATus:OPERation:CONDition?, 489
STATus:OPERation:ENABle, 490
STATus:OPERation:NTRansition, 491
STATus:OPERation:PTRansition, 492
STATus:OPERation[:EVENt]?, 489
STATus:PRESet, 493
STATus:QUEStionable:CONDition?, 493
STATus:QUEStionable:ENABle, 494
STATus:QUEStionable:HARDware:CONDition?, 495, 496
STATus:QUEStionable:HARDware:NTRansition, 497
STATus:QUEStionable:HARDware:PTRansition, 498
STATus:QUEStionable:HARDware[:EVENt]?, 495
STATus:QUEStionable:LIMit:CONDition?, 499
STATus:QUEStionable:LIMit:ENABle, 500, 505
STATus:QUEStionable:LIMit:NTRansition, 501
STATus:QUEStionable:LIMit:PTRansition, 502
STATus:QUEStionable:LIMit[:EVENt]?, 499
STATus:QUEStionable:NTRansition, 503
STATus:QUEStionable:PTRansition, 504
STATus:QUEStionable:SEARch:NTRansition, 506
STATus:QUEStionable:SEARch:PTRansition, 507
STATus:QUEStionable[:EVENt]?, 493
STATus:QUEStionableSEARch:CONDition?, 505
STATus:QUEStionableSEARch[:EVENt]?, 504
SYSTem:BEEPer:STATe, 516
SYSTem:BEEPer[:IMMediate], 516
SYSTem:DATE, 517
SYSTem:ERRor:COUNt?, 518
SYSTem:ERRor?, 517
SYSTem:EXTRef?, 518
SYSTem:INDex:POINt:SET, 519
SYSTem:INDex:SWEep:SET, 519
SYSTem:INDex:TIME, 520
SYSTem:INDex:TIME:SET, 521
SYSTem:KLOCk:KBD, 522
SYSTem:KLOCk:MOUSe, 523
SYSTem:KLOCk[:FPANel], 522
SYSTem:POFF, 523
SYSTem:PRESet, 523
SYSTem:TIME, 524
SYSTem:VERSion?, 524
TRIGger[:SEQuence]:EVENt[:TYPe], 525

TRIGger[:SEQuence]:SLOPe, 526
TRIGger[:SEQuence]:SOURce, 526
TRIGger[:SEQuence][:IMMediate], 525
graph file
save, 177

H

history,
manual printing, 2

I

I/O library
controlling peripherals from E4991A, 245
IEEE 32 bit floating point format, 121
IEEE 64 bit floating point format, 122
input device
lock, 31
Installation and Quick Start Guide, 4
internal data array
save
selection, 177
Italic
Font rules in this manual, 2

K

key
Font rules in this manual, 2
keyboard
lock, 31

L

LAN, 35
limit test function, 147
displays test condition and results, 148
on/off, 147
reads test results, 148
sets test limit, 147
sets test marker, 147
using questionable status limit event register, 148
load standard
defines standard values, 74
measures calibration data
using COM interface, 533
using GPIB command, 76
low-loss capacitor
measures calibration data
using COM interface, 533
using GPIB command, 76

M

macros
abruptly terminating macros, 231
automatically executing macros, 230
debugging, 229
executing macros, 230
execution error, 229
GPIB
controller mode, 33, 551
loading macros, 233
logic error, 229
macro recording, 228
recalling macros, 178
returns to measurement screen, 214
saving macros, 177, 232
stopping macros, 231
syntax error, 229
VBA help, 220
Visual Basic editor
startup/close, 214
magnetic material measurement
selection of measurement mode, 40
sizes of DUT, 40
Manual
About the Manual Regarding this Device, 4
manual changes, 549
manual printing history, 2
marker
continuous/discontinuous marker mode, 141
coupled mode, 141
delta mode
fixed delta mode, 142
selects mode, 142
displays marker list, 141
marker search
definition of peak search, 145
definition of target search, 145
execution, 146
partial search function, 144
questionable status search event register, 555
reads results using status report system, 146
selects search point, 144
tracking function, 146
measurement value
reads value, 142
selects format, 142
on/off, 140
selects data/memory trace, 141
sets active marker, 140
sets E4991A setting using marker value, 143
statical analysis function, 149
stimulus value
selects unit, 141
sets/reads value, 141
measurement failure
DC bias current/voltage limitation error, 604
DC bias overload error, 604
overload error, 604
PLL unlock error, 604
questionable status hardware event register, 555
measurement mode
selection, 40
measurement of inductors self-resonance point, 254

measurement parameters
in case of complex trace, 43
in case of scalar trace, 41
memory array, 124
memory trace, 199
memory trace array, 124
menu
Font rules in this manual, 3
message, 605
method, 238
mouse
lock, 31

N

number of measurement points
under linear/log sweep, 44
under segment sweep, 65

O

offset
set offset (scalar trace), 199
offset delay time, 92
open compensation
turns on/off open compensation, 95
open standard
defines standard values, 74, 93
measures calibration data
using COM interface, 533
using GPIB command, 76
measures fixture compensation data
using COM interface, 534
using GPIB command, 95
operation status event register, 555
Operational Manual, 4
OSC level sweep
selects OSC level sweep, 44
sweep range, 45
overload, 604

P

peripherals
controlling peripherals from E4991A, 245
phase display
sets unit, 42
turns on/off expand phase display, 42
PLL unlock, 604
port extension
offset delay time, 92
print
cancel, 196
color, 196
contents, 196
printout, 196
Programming Manual, 4
property, 238

Q

questionable status event register, 555
questionable status hardware event register, 555
questionable status limit event register, 555
questionable status search event register, 555
Quick Start Guide, 4

R

raw data array, 123
remote mode, 31, 34, 37
remote user interface function, 35

S

sample program
ext_cont.bas, 251
visa32.bas, 246
vpptype.bas, 246
sample programs
asc_read.bas, 131
asc_read.htb, 129
bias_mon.bas, 136
bias_mon.htb, 133
bsc_meas.bas, 267
bsc_meas.cls, 206, 272
bsc_meas.htb, 257
cal_inp.bas, 89
cal_inp.htb, 87
cal_meas.bas, 83
cal_meas.htb, 78
circuit.bas, 172
circuit.htb, 169
com_meas.bas, 102
com_meas.htb, 97
error.bas, 206
error.htb, 204
event when the measurement failure occurs in the analyzer, 272
example program for calibration coefficient transfer, 87, 89
example program for equivalent circuit analysis, 169, 172
example program for error handling, 204, 206
example program for execution of calibration, 78, 83
example program for execution of fixture compensation, 97, 102
example program for marker limit test function, 159, 163
example program for marker search function, 150, 154
example program for reading the data trace array (ASCII format), 129, 131
example program for reading the dc bias level monitor array, 133, 136
example program for saving/recalling a file, 180, 187
example program for setting the measuring conditions, 55, 59
example program for setting the segment sweep conditions, 66, 70
example program for the detection of a measurement end, 114, 116

lim_test.bas, 163
lim_test.htb, 159
measuring the self-resonant point of an inductor, 257, 267
mkr_sear.bas, 154
mkr_sear.htb, 150
save_rec.bas, 187
save_rec.htb, 180
segm_set.bas, 70
segm_set.htb, 66
setup.bas, 59
setup.htb, 55
sweep.bas, 116
swp_srq.htb, 114
scalar trace, 40
scale
auto scale, 51
manual setting
complex plane format, 52
linear Y-axis format, 51
log Y-axis format, 52
polar format, 52
selects data/memory trace, 51
SCPI
reads SCPI version, 524
segment sweep
creates segments, 64
dc bias
current limit maximum value, 65
output current level, 65
output mode, 64
output voltage level, 65
voltage limit maximum value, 65
delay time, 47
deletes all segments, 64
displays the segment sweep table, 64
frequency range, 65
number of measurement points, 65
OSC level, 65
OSC level unit, 64
point averaging factor, 65
reads the total number of segments, 64
selects segment sweep, 44
set segment parameters collectively, 65
Serial number plate, 550
short compensation
turns on/off short compensation, 95
short standard
defines standard values, 74, 93
measures calibration data
using COM interface, 533
using GPIB command, 76
measures fixture compensation data
using COM interface, 534
using GPIB command, 95
shutdown, 209, 210
source
CW frequency, 48
OSC level
under linear/log sweep, 48
under segment sweep, 65
standard event status register, 555
state file
recall, 178
save, 177
statical analysis function, 149
STEP, 248
stimulus array, 124
sweep
detects measurement end
using COM interface, 537
using GPIB command, 112
detects measurement start
using COM interface, 538
execution
using COM interface, 532
using GPIB command, 111
sweep direction, 44
sweep parameter, 44
sweep time
auto on/off, 47
sets time, 47
sweep type, 44

T

test fixture
agilent test fixture
reads electric length, 91
selection, 91
custom test fixture
selection, 91
sets electric length, 91
This Manual
Font Rules, 2
time
setting, 524
title, 199
tool bar
Font rules in this manual, 3
trace
displays title, 199
selects data/memory trace, 199
selects graph/text screen, 198
sets active trace, 198
sets offset, 199
sets trace, 40
trigger
continuous measurement, 111
measurement at any time, 111
trigger detection point, 109
trigger source, 109
trigger state, 108

U

user defined frequency / user defined power points
calibration, 75
user defined frequency / user defined power points
compensation, 94

V

vbreadme.txt, 247
VISA
application program for DC power supply(external instrument), 251
control flow with VISA, 247
importing definition files, 246
notes on using VISA library with VB, 247
online help of VISA library, 247
programming using VISA, 247
visa.hlp, 247
Visual Basic editor
close, 214
code window, 218
form designer, 218
module, 221
class module, 221
export, 223
import, 224
remove, 225
standard module, 221
user form, 221
object browser, 218
project, 221
project explorer, 216
property window, 216
startup, 214
toolbar, 215
toolbox, 218

W

window
split/overlay, 198